Clark County 2020 Survey Summary Reports
Springs Stewardship Institute
Volume 1 of 3

1. Buck Spring, 10/17/20
Survey Summary Report, Site ID 152983
Submitted 2/11/22 by Springs Stewardship Institute

Location: The Buck Spring ecosystem is located in Clark County in the Ivanpah-Pahrump Valleys 16060015 HUC, managed by the US Forest Service. The spring is located in the Humboldt-Toiyabe NF, Spring Mountains NRA, in the Wheeler Well USGS Quad, at 36.34264, -115.77691 measured using a GPS (WGS84). The elevation is approximately 2227 meters. Andrea Hazelton and Brianna Mann verified the site on 10/17/20 at 16:00. This survey was conducted under the Clark County SSI 2020 project using the Stevens et al. Level 1 protocol.

Fig 1.1 Buck Spring: The metal barrel well at the hillslope source, and the dry grazed patch of helocrenic habitat that surrounds it. The thin black pipe leads to a dry trough, 37 m downslope.

Physical Description: Buck Spring is a hillslope/anthropogenic spring. At this developed spring, there is a well made out of a 0.5-meter diameter metal barrel buried in the ground where there was once a hillslope spring source. The well has a cover that is stuck partly open so that insects, birds, and small mammals can get in. A thin black pipe leads from the well downslope to a trough 37 meters away. Subsurface seepage from the hillslope source surrounding the well supports a small, cienega-like patch of herbaceous vegetation, about 6 meters long. This spring is located on the creek-right (north) slope of a small canyon.

Access Directions: From the community of Cold Creek, drive for about 13 miles on Wheeler Pass Road. Turn left (east) onto FR 566. Drive 0.9 mi on FR 566 and turn left onto FR 566 B. Drive 2.2 mi and keep left at an unnamed junction. Drive 0.1 mi to the end of the road. Park and hike upstream to the spring, about 80 meters.

Survey Notes: There is no open water other than the water in the barrel. The trough downstream is dry. A surveyor searched 200 meters upstream and 100 meters downstream of the reported GPS coordinate and found no surface water. Inside the metal barrel there is 32 centimeters of standing water. There is woody flood debris in the dry channel/cienega. There is moist soil surrounding the well, supporting grasses which are grazed very close to the ground. The canyon has well-trodden horse trails running parallel to the canyon bottom. The open well poses a wildlife entrapment hazard.

Water Quality: Surveyors measured water quality at the source (inside the metal barrel). Location 1: at the spring source in standing water at 16:16.

Table 1.1 Buck Spring Water Quality Measurements.

Characteristic Measured	Value	Location Number	Device
Dissolved Solids (field) (ppt)	0.523	1	Hanna 9828 Multi
pH (field)	7.46	1	Hanna Multi 98194
Specific conductance (field) (µS/cm)	1047	1	Hanna Multi 98194
Temperature, air C	23	1	Handheld therm
Temperature, water C	11.66	1	Hanna Multi 98194

Assessment: Assessment scores were compiled in 5 categories and 9 subcategories, with 33 null condition scores, and 33 null risk scores. Aquifer functionality and water quality are good with significant restoration potential (average condition score 4) and there is moderate risk (average risk score 3). Geomorphology condition is poor with limited restoration potential (average condition score 2) and there is moderate risk (average risk score 3). Habitat condition is moderate with some restoration potential (average condition score 3) and there is moderate risk (average risk score 3). Biotic integrity is moderate with some restoration potential (average condition score 3) and there is moderate risk (average risk score 3). Human influence of site is moderate with

some restoration potential (average condition score 3.7) and there is low risk (average risk score 2.4). Overall, the site condition is moderate with some restoration potential and there is low risk.

Table 1.2 Buck Spring Assessment Scores. Condition scores range from 0 (extremely poor condition) to 6 (pristine condition) and risk scores range from 0 (no risk to the site) to 6 (extreme risk to the site).

Category	Condition	Risk
Aquifer Functionality & Water Quality	4	3
Geomorphology	2	3
Habitat	3	3
Biota	3	3
Human Influence	3.7	2.4
Overall Ecological Score	3.7	2.4

Management Recommendations: The well cover is stuck so that there is a 4 inch gap allowing small animals to get in, but there is also a high risk of becoming entrapped. Land managers should remove the cap completely and provide a ramp for escape, allowing wildlife to access this water safely, or else seal the well cap completely.

Fig 1.2 Buck Spring: The dry trough 37 m downslope of the metal barrel and hillslope source.

2. Bud Spring, 10/17/20
Survey Summary Report, Site ID 182100
Submitted 2/11/22 by Springs Stewardship Institute

Location: The Bud Spring ecosystem is located in Clark County in the Ivanpah-Pahrump Valleys 16060015 HUC, managed by the US Forest Service. The spring is located in the Humboldt-Toiyabe NF, Spring Mountains NRA, in the Wheeler Well USGS Quad, at 36.34692, -115.77351 measured using a GPS (WGS84). The elevation is approximately 2269 meters. Brianna Mann verified the site on 10/17/20 at 16:55. This survey was conducted under the Clark County SSI 2020 project using the Stevens et al. Level 1 protocol.

Fig 2.1 Bud Spring: The seeping dirt bank and small pool at the edge of the excavated tank. The photographer is at the southeast end of the saturated area.

Physical Description: Bud Spring is a rheocrene/anthropogenic spring. This site was historically excavated to form a cattle tank. Seepage emerges from a dirt bank at the edge of the excavated area, pooling within the tank. The excavated tank is 7 x 9 meters. The surrounding area contains dense wild rose and Ponderosa/Pinyon Juniper forest. The tank is in the bed of a canyon and the flood channel passes through the tank. The spring has a history of heavy use by horse, deer, and elk. The spring is 200 feet west of Rose Spring. Old water rights listed this as Pinyon Spring and Rose spring as Rosebud spring.

Access Directions: From the community of Cold Creek, drive for about 13 miles on Wheeler Pass Road. Turn left (east) onto FR 566. Drive 0.9 mi on FR 566 and turn left onto FR 566 B. Drive 2.2 mi and keep right at an unnamed junction. Drive 0.7 mi, park, and walk west (downhill) toward the spring. Alternately, you can navigate to Buck Spring (# 152983) and then walk upstream (north) for about 550 meters.

Survey Notes: Seepage is emerging from a 2 meter wide by 5 meter long area on the dirt bank at the edge of the tank, and pooling in a smaller arc within the tank. The rest of the excavated tank is dry with evidence of trampling and cracked, dried mud. There is evidence of recent and historic trampling at this site. Several birds were seen drinking from the surface water. The surface water is about 2 inches deep. There is some watercress and grass at the perimeter of the saturated area, otherwise little vegetation. There is some felled wood at the site.

Assessment: Assessment scores were compiled in 5 categories and 9 subcategories, with 33 null condition scores, and 33 null risk scores. Aquifer functionality and water quality are good with significant restoration potential (average condition score 4) and there is low risk (average risk score 2). Geomorphology condition is good with significant restoration potential (average condition score 4) and there is moderate risk (average risk score 3). Habitat condition is good with significant restoration potential (average condition score 4) and there is low risk (average risk score 2). Biotic integrity is good with significant restoration potential (average condition score 4) and there is moderate risk (average risk score 3). Human influence of site is good with significant restoration potential (average condition score 4.6) and there is negligible risk (average risk score 1.8). Overall, the site condition is moderate with some restoration potential and there is low risk.

Table 2.1 Bud Spring Assessment Scores. Condition scores range from 0 (extremely poor condition) to 6 (pristine condition) and risk scores range from 0 (no risk to the site) to 6 (extreme risk to the site).

Category	Condition	Risk
Aquifer Functionality & Water Quality	4	2
Geomorphology	4	3
Habitat	4	2
Biota	4	3
Human Influence	4.6	1.8
Overall Ecological Score	3.4	2

Management Recommendations: This site is used by a diversity of local wildlife. Consider testing the water quality over time to ensure this remains a clean water source for wildlife.

3. Cottonwood Spring, 12/09/19
Survey Summary Report, Site ID 137577
Submitted 2/11/22 by Springs Stewardship Institute

Location: The Cottonwood Spring ecosystem is located in Clark County in the Las Vegas Wash 15010015 HUC, managed by a private US owner. The spring is located in the Blue Diamond USGS Quad, at 36.04541, -115.40598 measured using a GPS (WGS84). The elevation is approximately 1040 meters. Corey Kallstrom, Kevin Guadalupe, Kathryn Gulley, Michael Schwemm, Corey Lange, and Alek Mendoza surveyed the site on 12/09/19 for 03:00 hours, beginning at 9:45, and collected data in 6 of 10 categories. This survey was conducted under the Clark County SSI 2020 project using the Stevens et al. Level 2 protocol.

Fig 3.1 Cottonwood Spring: View from the bridge looking towards the springhouse/source.

Physical Description: Cottonwood Spring is a rheocrene/anthropogenic spring. The spring source is altered by a concrete springhouse but this structure is still allowing the water to flow out. The spring outflow continues for 1.2 miles, meandering through the community park and neighborhood. There are pipes established before and below the small pedestrian bridge to divert water the landscaping plants near the source. Data were imported in February 2016 from a compilation of Don Sada's research. The Land Manager ID number is from this dataset. The site has 2 microhabitats, including A -- a 0 sqm springbox, B -- a 0 sqm channel.

Table 3.1 Cottonwood Spring Microhabitat characteristics.

Code	**A**	**B**
Name	Springbox	Channel
Area sqm		
Surface type	OTH	CH
Surface subtype	anthro	
Slope variability	Low	Low
Aspect TN	12	12
Slope degrees	5	3
Moisture (scale 1-10)	0	9
Water depth cm	0	11
Area % open water	0	95
Substrate		
1 - Clay %	0	20
2 - Silt %	0	25
3 - Sand %	0	30
4 - Fine gravel %	0	0
5 - Coarse gravel %	0	10
6 - Cobble %	0	0
7 - Boulder %	0	0
8 - Bedrock %	0	0
Organic %	0	10
Other % (anthropogenic)	100	5
Precipitate %	0	0
Litter %	0	27
Wood %	0	1
Litter Depth (cm)		5

Geomorphology: Cottonwood Spring emerges from an unconsolidated, alluvium rock layer. The emergence environment is subaerial, with a gravity flow force mechanism.

Access Directions: From Las Vegas, take Blue Diamond Road 160 south and follow it to the right where it becomes Hwy 159. From 159, take Arroyo road into Blue Diamond. Turn left on Allegro Street. Park at the corner of Cottonwood Drive and Allegro Street and walk less than 15 meters to the concrete springhouse.

Survey Notes: The spring source is heavily altered but the springs outflow is still functioning. This site is located in a residential area, so this site receives heavy visitation by the community.

Flow: Surveyors measured a flow of 2.4 liters/second, using a flume. Flow was adjusted for an estimate of 95% of site flow capture. Surveyors measured the flow below the bridge, approximately 4.5 m below the cement springbox. This spring is perennial.

Water Quality: The surveyors measured water quality directly below the springhouse where the flow first emerges. Location 1: at the spring source in flowing water at 10:10.

Table 3.2 Cottonwood Spring Water Quality Measurements.

Characteristic Measured	Value	Location Number	Device
Alkalinity, Total (mg/L)	210	1	LaMotte
Dissolved oxygen (field) (mg/L)	5.5	1	CHEMets DO kit
Dissolved Solids (field) (ppt)	0.416	1	Hanna Multi 98194
pH (field)	7.17	1	Hanna Multi 98194
Specific conductance (field) (µS/cm)	831	1	Hanna Multi 98194
Temperature, air C	12	1	Handheld therm
Temperature, water C	19	1	Hanna Multi 98194

Flora: Surveyors did not identify plants due to the survey taking place in December.

Fauna: No crayfish or fish were observed. Surveyors collected or observed 2 aquatic invertebrate taxa

Table 3.3 Cottonwood Spring Invertebrates.

Species	Lifestage	Habitat	Method	Rep#	Count	Species Detail
Basommatophora Physidae Physa		A	Collected spot		1	collected and waiting on genetics
Neotaenioglossa Hydrobiidae Pyrgulopsis		A	Collected spot		1	collected and waiting on genetics

4. Falls Spring, 12/03/20
Survey Summary Report, Site ID 108395
Submitted 2/11/22 by Springs Stewardship Institute

Location: The Falls Spring ecosystem is located in Clark County in the Lake Mead Arizona, Nevada 15010005 HUC, managed by the US Bureau of Land Management. The spring is located in the Gold Butte National Monument, in the Jumbo Peak USGS Quad, at 36.24295, -114.18858 measured using a GPS (WGS84). The elevation is approximately 1269 meters. Andrea Hazelton and Brianna Mann verified the site on 12/03/20 at 15:05. This survey was conducted under the Clark County SSI 2020 project using the Stevens et al. Level 1 protocol.

Fig 4.1 Falls Spring: The dry trough (left) adjacent to a 2-track dirt road, and the dry wash to the right. The wash bottom is vegetated with broom baccharis and sporadic junipers.

Physical Description: Falls Spring is a hypocrene/anthropogenic spring. There is a dry concrete trough next to a 2-track dirt road. A dry wash runs parallel to the road, across the road from the trough. The pipe that would have filled the trough is still in place. A section of pipe is exposed in the road about 50 meters south of the trough (in the wash, upstream of the trough). The original location of the source is not evident, but may have been some distance away.

Access Directions: This spring is at the southern end of Gold Butte National Monument, where as of 2020 most roads lack names or numbers. Surveyors should bring a topo

map and GPS to navigate to this spring. The spring is an approximately 20 minute drive south of Gold Butte Townsite.

Survey Notes: The trough is completely dry, as is the wash. The wash bottom is filled with broom baccharis (Baccharis sarothroides), suggesting somewhat shallow groundwater. However, there are also sporadic junipers in the wash bottom, indicating encroachment of upland plants.

Fig 4.2 Falls Spring: The dry trough. The inflow pipe is still in place (left side) but no longer functional.

5. Falls Spring, 12/03/20
Survey Summary Report, Site ID 181757
Submitted 2/11/22 by Springs Stewardship Institute

This location was previously reported as a spring, but on 12/03/20 surveyors determined that there is no spring at this location.

Location: The Falls Spring ecosystem is located in Clark County in the Lake Mead Arizona, Nevada 15010005 HUC, managed by the US Bureau of Land Management. The site is located in the Gold Butte National Monument, in the Jumbo Peak USGS Quad, at 36.24620, -114.19181 measured using a GPS (WGS84). The elevation is approximately 1238 meters. Brianna Mann verified the site on 12/03/20 at 15:25. This survey was conducted under the Clark County SSI 2020 project using the Stevens et al. Level 1 protocol.

Fig 5.1 Falls Spring: The reported springs location in a dry drainage bottom. The photographer is standing about 10 m downslope of the reported GPS coordinate.

Physical Description: This springs record and its 2001 survey were imported in February 2016 from a compilation of Don Sada's research. The Land Manager ID number is from this dataset. The only descriptive information provided by that dataset was that the site was dry. In 2020, SSI surveyors found no evidence of a spring in this dry drainage.

Access Directions: This spring is at the southern end of Gold Butte National Monument, where as of 2020 most roads lack names or numbers. Surveyors should bring a topo map and GPS to navigate to this spring. The spring is an approximately 20 minute drive south of Gold Butte Townsite.

Survey Notes: The surveyor looked 50 meters up the drainage and searched the adjacent landscape and found no evidence of a spring. The brushy drainage was dry.

6. Fence Spring, 10/15/20
Survey Summary Report, Site ID 251356
Submitted 2/11/22 by Springs Stewardship Institute

Location: The Fence Spring ecosystem is located in Clark County in the Sand Spring-Tikaboo Valleys 16060014 HUC, managed by the US Forest Service. The spring is located in the Humboldt-Toiyabe NF, Spring Mountains NRA, in the Willow Peak USGS Quad, at 36.38856, -115.75029 measured using a GPS (WGS84). The elevation is approximately 2333 meters. Talia Bar Yaacov, Tara Blake, Andrea Hazelton, Chantal Iosso, and Brianna Mann surveyed the site on 10/15/20 for 01:45 hours, beginning at 13:30, and collected data in 10 of 10 categories. This survey was conducted under the Clark County SSI 2020 project using the Stevens/GDE hybrid protocol.

Fig 6.1 Fence Spring: Looking upstream at the outflow channel and rose thicket from the downstream fenceline. The source is out of view, beyond the rose thicket.

Physical Description: Fence Spring is a hillslope spring. Flow emerges from a gravelly source and trickles down a poorly developed gravel-bed channel through a rose thicket. The spring is located at the bottom of a draw between two hillslopes. The site is surrounded by the remnants of a fence which was made of wood posts and wire mesh. There is a metal pipe sticking out of the ground at the source. There are parts of an old water wheel at the downstream end of the site. The microhabitats associated with the spring cover 2292 sqm. The site has 3 microhabitats, including A -- a 8 sqm pool, B -- a

170 sqm channel, C -- a 2114 sqm colluvial slope. The geomorphic diversity is 0.12, based on the Shannon-Weiner diversity index.

Geomorphology: Fence Spring emerges as a seepage or filtration spring from a sedimentary, limestone rock layer. The emergence environment is subaerial, with a gravity flow force mechanism. The site receives approximately 89% of available solar radiation, with 6026 Mj annually.

Access Directions: From the community of Cold Creek, drive south on Bonanza Camp Road for about 2 miles. Park and hike west about 1.2 km to the spring. The hiking is challenging because the shrubs are very dense; it is easiest to follow the horse trails.

Survey Notes: The flow sinks back into the ground 100 meters downstream of the source. The metal pipe at the source has a very slow drip but the vast majority of flow emerges directly from the ground. There is some evidence of horse use at the downstream end of the springs dependent habitat, but it is not extensive.

Flow: Surveyors measured a flow of 0.07 liters/second, using a timed flow volume capture method. Flow was adjusted for an estimate of 90% of site flow capture. Surveyors measured flow 4 m downstream of the source in the outflow channel. This spring is perennial.

Water Quality: Surveyors measured the water quality at the source using a Hanna Combo (low green). Location 1: at the spring source in flowing water at 14:14.

Table 6.1 Fence Spring Water Quality Measurements.

Characteristic Measured	Value	Location Number	Device
Alkalinity, Total (mg/L)	220	1	LaMotte
Dissolved oxygen (field) (mg/L)	7	1	CHEMets DO kit
Dissolved Solids (field) (ppt)	0.251	1	Hanna Combo
pH (field)	7.71	1	Hanna Combo
Specific conductance (field) (µS/cm)	481	1	Hanna Combo
Temperature, air C	20	1	Handheld therm
Temperature, water C	9.3	1	Hanna Combo

Flora: Andrea Hazelton was the botanist for this survey. Surveyors identified 13 plant species at the site, with 0.0057 species/sqm. These included 11 native and 2 nonnative species.

Table 6.2 Fence Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	9	5
Shrub	3	0
Mid-canopy	0	0
Tall canopy	0	0
Basal	0	0
Aquatic	0	0
Non-vascular	1	1

Table 6.3 Fence Spring Vegetation % Cover in Microhabitats.

Plant Species	Cover Code	Native Status	Wetland Status	Comments	A	B	C
Aquilegia formosa	GC	N	W		0	1	0.1
Artemisia tridentata	SC	N	U		0	0	1
Epilobium ciliatum	GC	N	W		0	0.1	0.01
Medicago lupulina	GC	I	WR		0	0	0.01
Mimulus guttatus	GC	N	WR		0	2	0.01
Oenothera	GC	N	F		0	0	0.01
Poaceae	GC	NI			0	5	1
Ribes	SC	N	F		0	0	1
Rosa woodsii	SC	N	F		0	20	90
Sambucus	GC	N	F		0	0	1
unknown moss	NV	N?	WR		2	2	0.01
Verbascum thapsus	GC	I	U		0	1	0.1
Veronica anagallis-aquatica	GC	N	A		3	2	0.01

Fauna: Brianna Mann was the wildlife biologist at this site. Surveyors collected or observed 4 aquatic and 6 terrestrial invertebrate taxa and 7 vertebrate taxa.

Table 6.4 Fence Spring Invertebrates.

Species	Lifestage	Habitat	Method	Rep#	Count	Species Detail
Annelida			Collected spot		2	
Araneae	Ad	T	Collected spot		1	
Coleoptera	L		Collected spot		6	
Coleoptera	Ad		Collected spot		3	
Coleoptera Dytiscidae	Ad	A	Collected spot		2	
Diptera	L		Collected spot		3	
Diptera	Ad	T	Spot		1	many
Ephemeroptera	L	A	Collected spot		28	
Hymenoptera Apidae Apis mellifera	Ad	T	Spot		1	many
Hymenoptera Vespidae Vespula	Ad	T	Spot		11	
Lepidoptera Nymphalidae	Ad	T	Spot		1	orange and black fritillary
Orthoptera	Ad	T	Spot		1	many
Trichoptera	L	A	Collected spot		2	
Turbellaria	Ad	A	Collected spot		7	

Table 6.5 Fence Spring Vertebrates.

Vertebrate Species Common Name	Count	Detection	Comments
Sparrow		obs	dusty brown dorsal, pale ventral, speckled
Horse		sign	scat, tracks
Elk		sign	scat, tracks
Squirrels, Marmots, Chipmunks	1	obs	
American Crow	3	call	
Hawk	1	obs	white ventral, seen diving nearby
Blue Jay	1	obs	

Table 6.6 Fence Spring Hydrologic Alteration

Water diversion (permanently diverted)	
Water diversion (water eventually returns to site)	X
Upgradient extraction of surface water or groundwater (prespring emergence)	
Downgradient capture of surface water or groundwater (post-spring emergence)	
Extraction of water within a wetland	
Extraction of water at spring source	X
Regulated water flow by impoundment/dam	
Pollution	
Flooding	
Wells	
Other hydrologic disturbance	
None observed	
Diverted volume	
Percent diverted	

Table 6.7 Fence Spring Soil Alteration

Channel erosion	
Compaction	
Debris flow	
Deposition	
Displacement of soil	X
Erosion (general)	
Evaporate deposition	
Excavation	
Ground disturbance (general)	X
Gully erosion	
Mass wasting	
Mining	
Pedestals or hummocks (by people or animals)	
Pedestals (small-scale, rain-splash induced)	
Pipes	X
Rill erosion	
Ruts (from vehicle tread)	
Sheet erosion	
Slump	
Splash erosion/soil crust	
Wind erosion	
Soil mixing/churning	
Soil removal (peat mining)	
Trails (by people or animals)	
Other soil disturbance	
None observed	

Table 6.8 Fence Spring Structures

Buried utility corridors	
Enclosure (such as spring house, spring box or concrete enclosure)	
Erosion control structure	
Exclosure fence	X
Oil and gas well	
Pipeline	
Point source pollution	
Power lines	
Road (includes construction and maintenance)	
Other structural disturbance	
None observed	

Table 6.9 Fence Spring Recreational Effects

Camp sites	
Tracks or trails by vehicles (ATV, 4-wheel drive, etc.)	
Other recreational disturbance	
None observed	X

Table 6.10 Fence Spring Animal Effects (including multiple)

Beaver activity	
Feral animals	X
Grazing or browsing (by ungulates)	X
Wild animals	
Livestock	
Trails by animals or people	
Trampling (by ungulates, native or nonnative)	X
Other animal disturbance	
None observed	

Table 6.11 Fence Spring Miscellaneous (including multiple)

Fire	
Tree cutting (timber harvest or other)	
Refuse disposal	
Other misc disturbance	
None observed	X

Table 6.12 Fence Spring Management Indicators

Management Indicators	Response	Comment
Hydrology		
Aquifer Functionality: No evidence suggests that the aquifer supplying groundwater to the site is being affected by groundwater withdrawal or loss of recharge.	True	
Watershed Functionality: Within the watershed, no evidence suggests upstream/upgradient hydrologic alteration that could adversely affect the GDE site.	True	
Water Quality: Changes in water quality (surface or subsurface) are not affecting the groundwater dependent ecosystem site.	True	
Geomorphology and Soils		
Landform Stability: No evidence of human-caused mass movement or other surface disturbance affecting the GDE site stability.	True	
Runout Channel: The channel, if present, is functioning naturally and is not entrenched, eroded, or otherwise substantially altered.	True	
Soil Integrity: Soils are intact and functional. For example, saturation is sufficient to maintain hydric soils, if present; there is not excessive erosion or deposition.	False	pedestals in upper outflow channel
Biology		
Vegetation Composition: Site has anticipated cover of plant species associated with the site environment, and no evidence suggests that upland species are replacing hydric species.	False	closely grazed
Vegetation Condition: Vegetation exhibits seasonally appropriate health and vigor.	False	closely grazed
TES, SOI/SOC, Focal Floral Species: Anticipated floral species are present.	True	
Faunal Species: Anticipated aquatic and terrestrial faunal species associated with the site environment are present.	True	
TES, SOI/SOC, Focal Faunal Species: Anticipated faunal species are present.	True	
Invasive Species: Invasive floral and faunal species are not established at the site.	True	minimal cover of exotic plants, minimal horse use
Disturbances		
Flow Regulation: Flow regulation is not adversely affecting the site.	True	
Construction and Road Effects: Construction, reconstruction, or maintenance of physical improvements, including roads, is not adversely affecting the site.	True	
Fencing Effects: Protection fencing and exclosures are appropriate and functional.	False	fence needs repair
Herbivore Effects: Herbivory is not adversely affecting	False	plants closely grazed; hummocks/pedestals

the site.		
Recreational Effects: Recreational uses, including trails, are not adversely affecting the site.	True	
Other Disturbance Effects: Wildland fire, insect, disease, wind throw, avalanches, or other disturbances are not adversely affecting the site.	True	
Administrative Context		
Cultural Values: Archaeological, historical, or tribal values will not affect inventory, restoration, use, or management of this site.		
Land Ownership: The entire site and immediate area is under the jurisdiction and management of the Forest Service.		
Other Landowner Actions: Activities or management on lands outside Forest Service jurisdiction are not adversely affecting the site.		
Land Management Plan: The land and resource management plan provides for effective site protection.		
Environmental Compliance: Authorized and administrative uses are in compliance and are not adversely affecting the site.		
Water Uses: There are no substantial water uses in the watershed, or in the aquifer supplying groundwater to the site, that could directly or cumulatively adversely affect the GDE.		
Water Rights: Water rights have been filed for the site under state law or water uses exempted under state law are documented. FS federal reserved rights documented as appropriate. Third-party water use in accordance with all elements of the water right or conditions of the exemption, & with FS authorization that allows the use.		

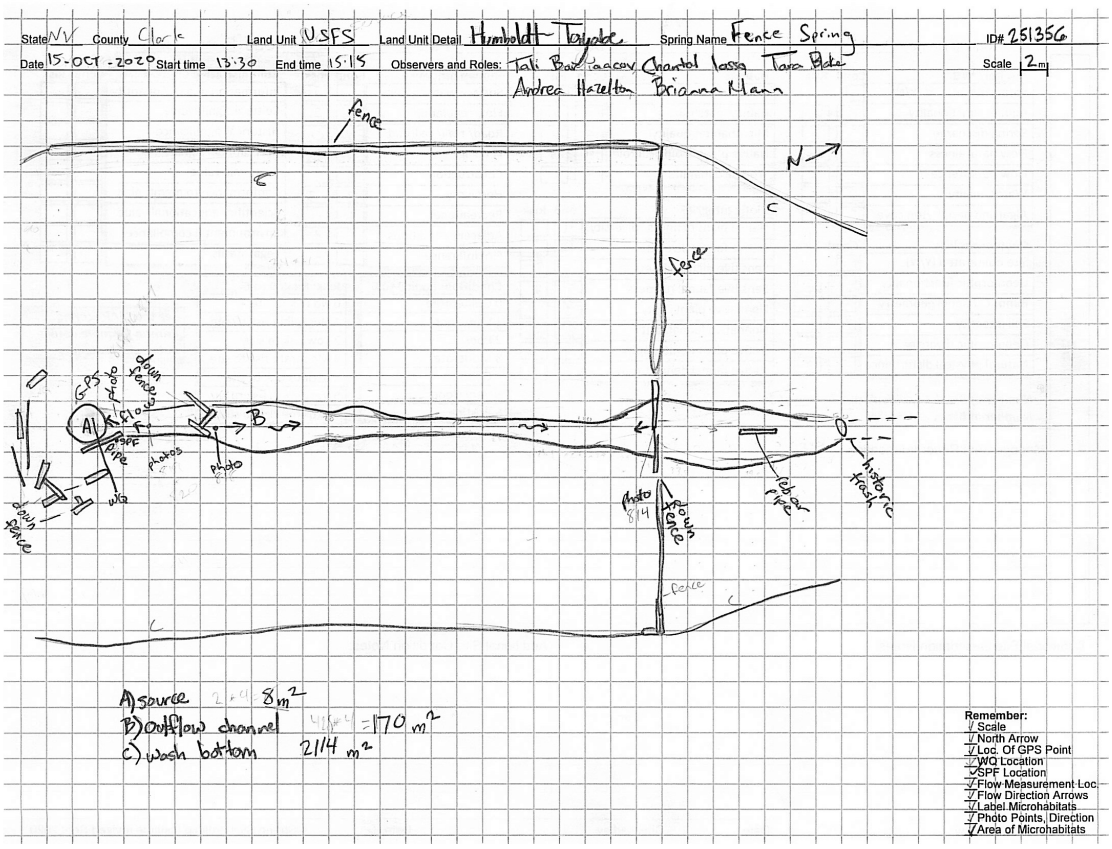

Fig 6.2 Fence Spring Sketchmap.

Fig 6.3 Fence Spring: The hillslope source.

Fig 6.4 Fence Spring: The flow measurement location 4 m downstream of the source.

7. Grapevine Spring, 12/03/20
Survey Summary Report, Site ID 108557
Submitted 2/11/22 by Springs Stewardship Institute

This location was previously reported as a spring, but on 12/03/20 surveyors determined that there is no spring at this location.

Location: The Grapevine Spring ecosystem is located in Clark County in the Lake Mead Arizona, Nevada 15010005 HUC, managed by the US Bureau of Land Management. The site is located in the Gold Butte National Monument, in the Jumbo Peak USGS Quad, at 36.23944, -114.16942 measured using a GPS (WGS84). The elevation is approximately 1330 meters. Andrea Hazelton and Brianna Mann verified the site on 12/03/20 at 14:30. This survey was conducted under the Clark County SSI 2020 project using the Stevens et al. Level 1 protocol.

Fig 7.1 Grapevine Spring: The dry excavated pond. Surveyors searched the rock outcrop to the left and found no evidence of a spring, and no grapevines.

Physical Description: Grapevine Spring is a hypocrene/anthropogenic spring. Some information about this site was imported in February 2016 from a compilation of Don Sada's research. The Land Manager ID number is from this dataset, and the spring type was listed as dry. SSI surveyors in 2020 described this site as a dry excavated pond surrounded by a fence. The fence is open on one side. It is mapped as Grapevine Spring on old topo maps.

Access Directions: This spring is at the southern end of Gold Butte National Monument, where as of 2020 most roads lack names or numbers. Surveyors should bring a topo map and GPS to navigate to this spring. The spring is an approximately 20 minute drive south of Gold Butte Townsite.

Survey Notes: Surveyors searched the granite outcrop east of the pond and found no evidence of a spring. The excavated pond is completely dry, and has a bathtub ring of precipitates. There is evidence of heavy historic cattle use, including hoof prints and old scat. There are no grapevines in evidence.

8. Horse Trail Spring, 10/15/20
Survey Summary Report, Site ID 251372
Submitted 2/11/22 by Springs Stewardship Institute

Location: The Horse Trail Spring ecosystem is located in Clark County in the Sand Spring-Tikaboo Valleys 16060014 HUC, managed by the US Forest Service. The spring is located in the Humboldt-Toiyabe NF, Spring Mountains NRA, in the Cold Creek USGS Quad, at 36.39824, -115.74695 (WGS84). The elevation is approximately 2120 meters. Talia Bar Yaacov, Tara Blake, Chantal Iosso, Andrea Hazelton, and Brianna Mann surveyed the site on 10/15/20 for 02:9 hours, beginning at 9:36, and collected data in 10 of 10 categories. This survey was conducted under the Clark County SSI 2020 project using the Stevens/GDE hybrid protocol.

Fig 8.1 Horse Trail Spring: The main rheocrenic source where surveyors measured water quality.

Physical Description: Horse Trail Spring is a rheocrene spring. Flow emerges into the bed of a dry northeast-trending wash. Adjacent to the flowing rheocrenic source, there is a seeping source on the left bank of the channel. The flow rate in the channel gradually increases for at least 30 meters downstream of these first two sources, indicating additional sub-aquatic rheocrene sources. The source is surrounded by many large, downed trees, indicating fire in the past. The channel substrate is coarse, angular gravel and cobbles. The microhabitats associated with the spring cover 72 sqm. The site has 3 microhabitats, including A -- a 29 sqm channel, B -- a 14 sqm low gradient cienega, C -- a 29 sqm margin. The geomorphic diversity is 0.46, based on the Shannon-Weiner diversity index.

Geomorphology: Horse Trail Spring emerges as a seepage or filtration spring from a sedimentary, limestone rock layer. The emergence environment is subaerial, with a gravity flow force mechanism. The site receives approximately 90% of available solar radiation, with 6085 Mj annually.

Access Directions: Drive through the community of Cold Creek on the main road. This road becomes Bonanza Camp Road after passing out of town on the south end. Almost immediately, there is a pull-out on the right that leads to a junction with a jeep road. Take this 4-wheel-drive road toward the west as far as you are comfortable driving, then walk. The spring is up the wash just west of Mike Spring, 236 meters to the north.

Survey Notes: There is a small outflow at the main rheocrenic source which gains volume and speed down the channel. The source area is heavily trampled by ungulates. Established wild horse trails run along the upper side of the spring. The diffuse seeping source on the left bank is mostly bare, churned mud, due to ungulate trampling and grazing. The wash is lined with moderate wild rose cover. There is no tall tree cover. Moss and algae cover much of the muddy area. The stream channel also has significant moss cover.

Flow: Surveyors measured a flow of 0.2 liters/second, using a timed flow volume capture method. The surveyor measured flow 25 m from the source. Surveyors created a dam and used a tube to localize flow.

Water Quality: Location 1: at the spring source in flowing water at 09:09.

Table 8.1 Horse Trail Spring Water Quality Measurements.

Characteristic Measured	Value	Location Number	Device
Alkalinity, Total (mg/L)	197	1	LaMotte
Dissolved oxygen (field) (mg/L)	5.5	1	CHEMets DO kit
Dissolved Solids (field) (ppt)	0.254	1	Hanna Combo
pH (field)	6.89	1	Hanna Combo
Specific conductance (field) (µS/cm)	507	1	Hanna Combo
Temperature, air C	19	1	Handheld therm
Temperature, water C	10.4	1	Hanna Combo

Flora: Andrea Hazelton was the botanist. Surveyors identified 16 plant species at the site, with 0.2222 species/sqm. These included 11 native and 5 nonnative species.

Table 8.2 Horse Trail Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	10	7
Shrub	4	0
Mid-canopy	0	0
Tall canopy	0	0
Basal	0	0
Aquatic	0	0
Non-vascular	2	1

Table 8.3 Horse Trail Spring Vegetation % Cover in Microhabitats.

Plant Species	Cover Code	Native Status	Wetland Status	Comments	A	B	C
Abies concolor	SC	N	U		0	0	1
algae	NV	N?	A		0.1	2	0
Aquilegia formosa	GC	N	W		0.1	2	0
Artemisia tridentata	SC	N	U		0	0	0.5
Bromus tectorum	GC	I	U		0	0	0.01
Juncus saximontanus	GC	N	W		0	0	0.5
Medicago lupulina	GC	I	WR		0	0	0.5
Mimulus guttatus	GC	N	WR		0.1	1	0.1
Nasturtium officinale	GC	I	W		2	0	2
Ranunculus	GC	N	WR		0.1	2	5
Ribes cereum	SC	N	U		0	3	2
Rosa woodsii	SC	N	F		2	5	20
Schedonorus arundinaceus	GC	I	F		0.5	1	2
unknown Bryophyte (moss, liverwort, hornwort)	NV	N?		moss	1	0.5	0.1
Verbascum thapsus	GC	I	U		0.1	3	0.5
Veronica anagallis-aquatica	GC	N	A		0	0.5	0

Fauna: Brianna Mann was the wildlife biologist at this site. Surveyors collected or observed 4 aquatic and 5 terrestrial invertebrate taxa and 5 vertebrate taxa.

Table 8.4 Horse Trail Spring Invertebrates.

Species	Lifestage	Habitat	Method	Rep#	Count	Species Detail
Annelida			Collected spot		3	
Coleoptera	Ad		Collected spot		5	
Coleoptera	L		Collected spot		3	
Coleoptera Dytiscidae	Ad	A	Collected spot		1	
Diptera	Ad	T	Collected spot		2	
Diptera Simuliidae	L	T	Collected spot		1	
Ephemeroptera	L	A	Collected spot		10	
Hymenoptera Apidae Apis mellifera	Ad	T	Spot		3	
Lepidoptera	Ad	T	Spot		1	moth, small
Plecoptera	L	A	Collected spot		7	
Trichoptera	L	A	Collected spot		3	

Table 8.5 Horse Trail Spring Vertebrates.

Vertebrate Species Common Name	Count	Detection	Comments
Steller's Jay	3	obs	
Horse		sign	scat, tracks, trails
Rabbit		sign	scat
American Crow	1	call	
Hawk	1	obs	

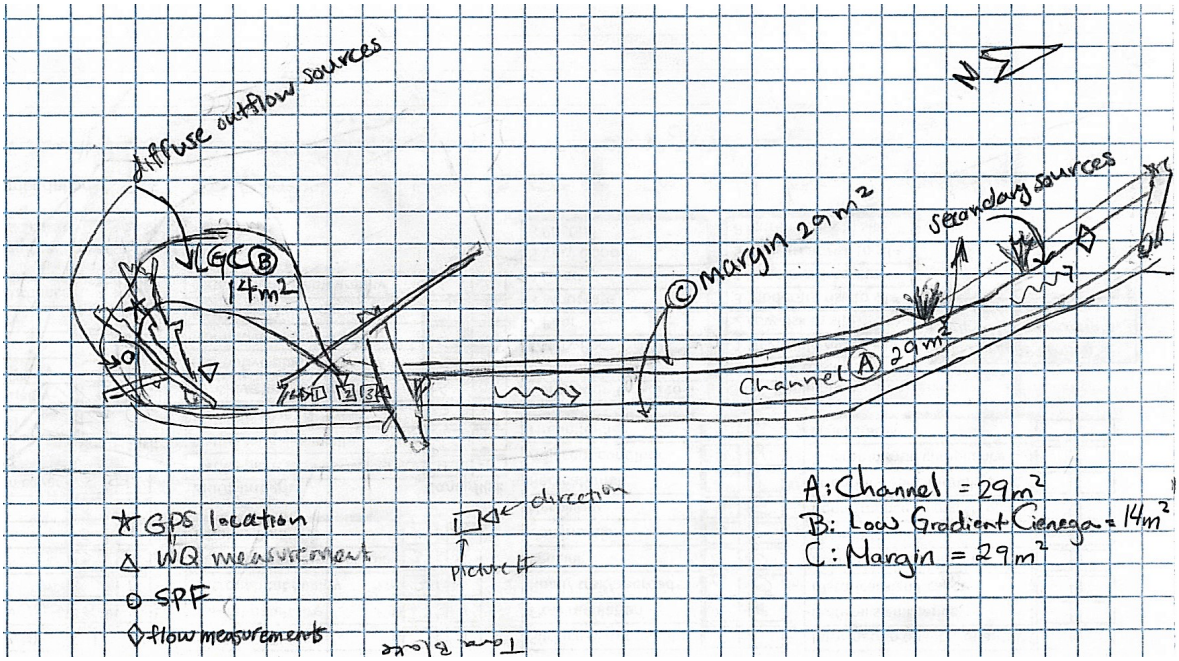

Fig 8.2 Horse Trail Spring Sketchmap.

Fig 8.3 Horse Trail Spring: The muddy, diffuse seeping source on the left bank of the stream, just west of the main flowing source.

Fig 8.4 Horse Trail Spring: A large downed tree across the outflow channel, about 8 m downstream of the source.

9. Horsetrail Unnamed Spring, 10/16/20
Survey Summary Report, Site ID 153129
Submitted 2/11/22 by Springs Stewardship Institute

Location: The Horsetrail Unnamed Spring ecosystem is located in Clark County in the Sand Spring-Tikaboo Valleys 16060014 HUC, managed by the US Forest Service. The spring is located in the Humboldt-Toiyabe NF, Spring Mountains NRA, in the Willow Peak USGS Quad, at 36.41838, -115.78481 measured using a GPS (WGS84). The elevation is approximately 1929 meters. Andrea Hazelton and Brianna Mann verified the site on 10/16/20 at 13:40. This survey was conducted under the Clark County SSI 2020 project using the Stevens et al. Level 1 protocol.

Fig 9.1 Horsetrail Unnamed Spring: A water-stained backwall (the wall is dry) with dead moss peeling off the bedrock. This is the uppermost evidence of a spring in the drainage.

Physical Description: Horsetrail Unnamed Spring is a rheocrene/hypocrene spring. This site is in the bed of a small bedrock canyon at the north end of the Spring Mountains. There is evidence of past flow (water stains, dead moss) on the bedrock portions of the channel bed. The surrounding landscape is hilly and vegetated with shrubby Gambels oak and chaparral. The site is located within a moderately steep draw with frequent fractured bedrock. There is evidence in the canyon of periodic flooding.

Access Directions: From the community of Cold Creek, travel on Wheeler Pass Road for 3.8 mi. Just past Willow Creek Campground, there is a junction where it is necessary to turn left to stay on Wheeler Pass Road. Do not take this left; rather, continue straight to follow the creek for another 0.5 miles. Turn left onto a minor dirt road and drive until the road ends. Park and hike southwest a little over 1 km to the spring. As the landscape is dense with chaparral, it is easiest to follow horse trails.

Survey Notes: This spring is dry, but must have been wet somewhat recently, as the rock is quite water stained. There is a dead monkey flower plant about 30 meters downstream from the uppermost water stains, indicating that flow was present for quite a while before the spring dried. Bobcat scat was observed 40 meters upstream of the spring. There are horse trails leading to the spring and plenty of horse, elk, and rabbit scat in the vicinity. Skunk scat was also observed.

Assessment: Assessment scores were compiled in 4 categories and 32 subcategories, with 10 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are undetermined due to null scores (average condition score 0) and there is very high risk (average risk score 5). Geomorphology condition is good with significant restoration potential (average condition score 4.6) and there is negligible risk (average risk score 1). Habitat condition is very poor with very limited restoration potential (average condition score 0.5) and there is very high risk (average risk score 5.4). Biotic integrity is poor with limited restoration potential (average condition score 2.5) and there is high risk (average risk score 3.9). Human influence of site is good with significant restoration potential (average condition score 4.4) and there is negligible risk (average risk score 1.6). Overall, the site condition is poor with limited restoration potential and there is moderate risk.

Table 9.1 Horsetrail Unnamed Spring Assessment Scores. Condition scores range from 0 (extremely poor condition) to 6 (pristine condition) and risk scores range from 0 (no risk to the site) to 6 (extreme risk to the site).

Category	Condition	Risk
Aquifer Functionality & Water Quality	0	5
Geomorphology	4.6	1
Habitat	0.5	5.4
Biota	2.5	3.9
Human Influence	4.4	1.6
Overall Ecological Score	2.7	3.2

Management Recommendations: This spring is dry. Consider if groundwater pumping is influencing the aquifer. The surrounding landscape is in good condition, ecologically, but wildlife that historically relied on this spring may be negatively impacted.

10. Ice Falls Spring Left, 10/27/20
Survey Summary Report, Site ID 251553
Submitted 2/11/22 by Springs Stewardship Institute

Location: The Ice Falls Spring Left ecosystem is located in Clark County in the Ivanpah-Pahrump Valleys 16060015 HUC, managed by the US Forest Service. The spring is located in the Humboldt-Toiyabe NF, Spring Mountains NRA, in the Griffith Peak USGS Quad, at 36.22679, -115.67996 measured using a GPS (WGS84). The elevation is approximately 2512 meters. Andrea Hazelton and Larry Stevens verified the site on 10/27/20 at 12:20. This survey was conducted under the Clark County SSI 2020 project using the Stevens et al. Level 1 protocol.

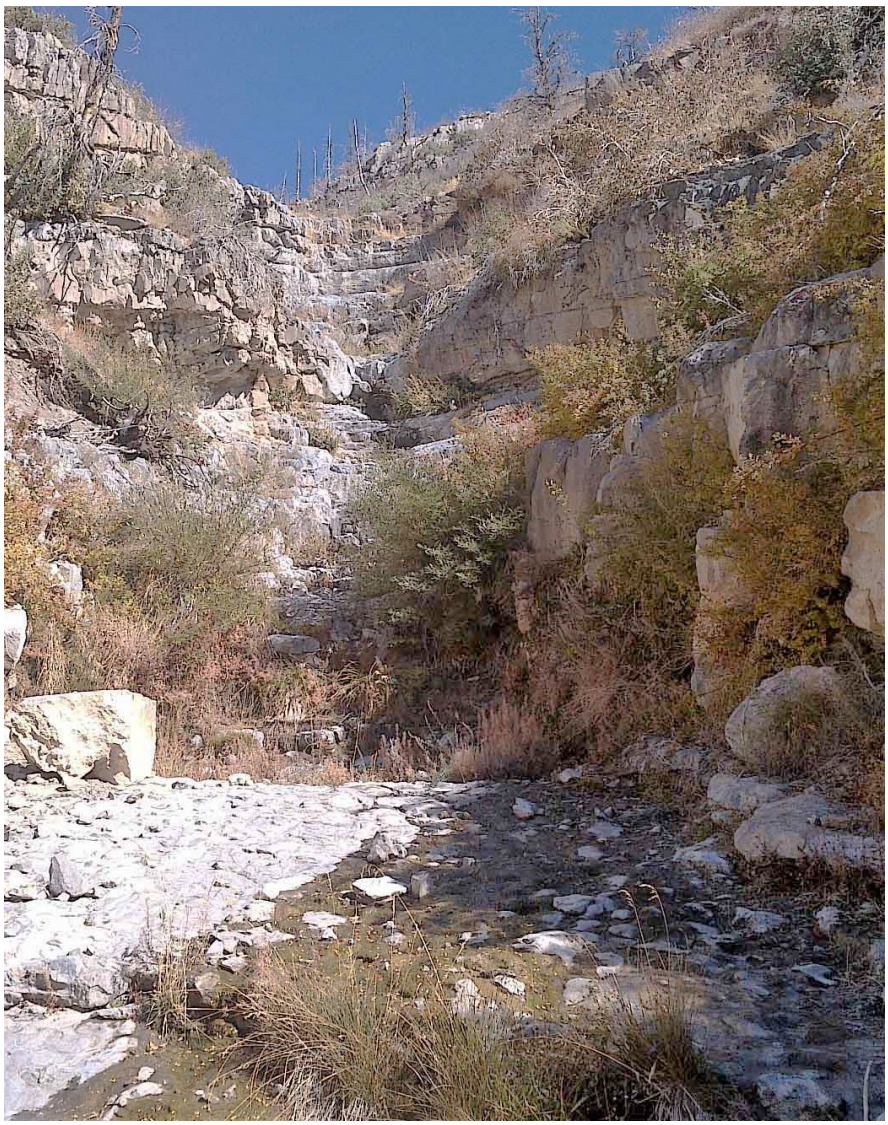

Fig 10.1 Ice Falls Spring Left: Seepage emerges from the ledges on the left canyon wall (right side of the photo) and collects in the canyon bottom, flowing down to merge with outflow from Ice Falls Spring Right, about 150 meters downstream (out of view, behind the photographer).

Physical Description: Ice Falls Spring Left is a hanging garden spring. Flow emerges out of bedrock ledges on the left wall of a steep narrow canyon. There may be additional sources farther upstream, but the SSI surveyor in October 2020 could not safely climb any farther up-canyon in the time allotted. Flow from this spring continues downstream for about 150 meters, where it merges with flow from a spring in the next side canyon to the west (Ice Falls Spring Right, SSI ID 251554). At the time of the October 2020 survey, the combined flow from these two sources formed icicles as it flowed over a bedrock ledge, earning both springs their names.

Geomorphology: Ice Falls Spring Left emerges as a contact spring from a sedimentary, limestone rock layer. The emergence environment is subaerial, with a gravity flow force mechanism.

Access Directions: From Hwy 160 about 5 miles east of the town of Pahrump, turn north onto Trout Canyon Road and drive for about 10 miles. The road leads into a ranch that has been developed into a small subdivision with a No Trespassing sign. Pull off the road just before the ranch entrance and park. Just to the west, there is a wash that parallels the road; this is Trout Creek. Walk about 3 miles up Trout Creek. This is a somewhat rough hike which takes a few hours. It may be possible to drive most of the way to this spring on an ATV, to save time.

Survey Notes: Emergent wetland vegetation, especially monkeyflower (Mimulus) grew in the channel bed and from the seeping ledges. There was no evidence of human alteration at the site, except that the 2013 fire resulted in debris flows that scoured the channel. Surveyors found remains of a dead golden eagle (feathers only) about 200 meters downstream. Surveyors detected a few non-native plants in the canyon downstream of the source: cheatgrass (Bromus tectorum), mullein (Verbascum thapsus), and a single Tamarix. Future surveyors should allot more time to survey this and other nearby springs; there may be more sources in this steep side canyon.

Flow: Surveyors measured a flow of 0.67 liters/second, using a timed flow volume capture method. Surveyors measured flow 30 m downstream of the confluence of outflow from Ice Falls Spring Left (comprising 95% of measured flow) and Ice Falls Spring Right (comprising 5% of measured flow). Site % capture is adjusted to calculate the correct flow rates. This spring is perennial.

Fauna: Surveyors collected or observed 4 aquatic invertebrate taxa

Table 10.1 Ice Falls Spring Left Invertebrates.

Species	Lifestage	Habitat	Method	Rep#	Count	Species Detail
Ephemeroptera	L	A	Collected spot		4	
Hemiptera Gerridae	Ad	A	Collected spot		2	
Trichoptera	L	A	Collected spot		3	
Turbellaria	Ad	A	Collected spot		2	

Fig 10.2 Ice Falls Spring Left: The vegetated seep line on the left canyon wall.

Fig 10.3 Ice Falls Spring Left: Icicles form where flow from the two Ice Falls Springs passes over a bedrock ledge.

Fig 10.4 Ice Falls Spring Left: The flow measurement location, 30 meters downstream of the confluence of outflow from Ice Falls Spring Left and Ice Falls Spring Right. Approximately 95% of the flow passing through the pipe is from this spring.

11. Ice Falls Spring Right, 10/27/20
Survey Summary Report, Site ID 251554
Submitted 2/11/22 by Springs Stewardship Institute

Location: The Ice Falls Spring Right ecosystem is located in Clark County in the Ivanpah-Pahrump Valleys 16060015 HUC, managed by the US Forest Service. The spring is located in the Humboldt-Toiyabe NF, Spring Mountains NRA, in the Griffith Peak USGS Quad, at 36.22666, -115.68273 measured using a GPS (WGS84). The elevation is approximately 2414 meters. Andrea Hazelton and Larry Stevens verified the site on 10/27/20 at 12:20. This survey was conducted under the Clark County SSI 2020 project using the Stevens et al. Level 1 protocol.

Fig 11.1 Ice Falls Spring Right: Seepage emerging from the dirt slope on the left side of this steep narrow canyon. The photographer is facing up-canyon.

Physical Description: Ice Falls Spring Right is a hillslope/rheocrene spring. Seepage emerges from wet patches of soil on the creek-left side of a steep, narrow canyon. The flow continues down the canyon for about 70 meters, where it merges with flow from a spring in the next side canyon to the east (Ice Falls Spring Left, SSI ID 251553). At the time of the October 2020 survey, the combined flow from these two sources formed icicles as it flowed over a bedrock ledge, earning both springs their names.

Geomorphology: Ice Falls Spring Right emerges as a seepage or filtration spring from a sedimentary, limestone rock layer. The emergence environment is subaerial, with a gravity flow force mechanism.

Access Directions: From Hwy 160 about 5 miles east of the town of Pahrump, turn north onto Trout Canyon Road and drive for about 10 miles. The road leads into a ranch that has been developed into a small subdivision with a No Trespassing sign. Pull off the road just before the ranch entrance and park. Just to the west, there is a wash that parallels the road; this is Trout Creek. Walk about 3 miles up Trout Creek. This is a somewhat rough hike which takes a few hours. It may be possible to drive most of the way to this spring on an ATV, to save time.

Survey Notes: There was no evidence of human alteration at the site, except that the 2013 fire resulted in debris flows that scoured the channel. Surveyors found remains of a dead golden eagle (feathers only) about 200 meters downstream. Surveyors detected a few non-native plants in the canyon downstream of the source: cheatgrass (Bromus tectorum), mullein (Verbascum thapsus), and a single Tamarix. Future surveyors should allot more time to survey this and other nearby springs; there may be more sources in this steep side canyon.

Flow: Surveyors measured a flow of 0.035 liters/second, using a timed flow volume capture method. Surveyors measured flow 30 m downstream of the confluence of outflow from Ice Falls Spring Left (comprising 95% of measured flow) and Ice Falls Spring Right (comprising 5% of measured flow). Site % capture is adjusted to calculate the correct flow rates.

Fig 11.2 Ice Falls Spring Right: Seepage from this spring is just visible in the shadowed portion of the canyon bed, near the boulder at the center of this photo.

Fig 11.3 Ice Falls Spring Right: The flow measurement location, 30 meters downstream of the confluence of outflow from Ice Falls Spring Left and Ice Falls Spring Right. Approximately 5% of the flow passing through the pipe is from this spring.

Fig 11.4 Ice Falls Spring Right: Icicles form where flow from the two Ice Falls Springs passes over a bedrock ledge.

12. Intermittent Spring, 10/07/20
Survey Summary Report, Site ID 19665
Submitted 2/11/22 by Springs Stewardship Institute

Location: The Intermittent Spring ecosystem is located in Clark County in the Ivanpah-Pahrump Valleys 16060015 HUC, managed by the US Bureau of Land Management. The spring is located in the Bureau of Land Management NV, in the Griffith Peak USGS Quad, at 36.16296, -115.73475 measured using a GPS (WGS84). The elevation is approximately 1386 meters. Larry Stevens, Jeri Ledbetter, Chantal Iosso, Talia Bar Yaacov, and Tara Blake verified the site on 10/07/20 at 10:30. This survey was conducted under the Clark County SSI 2020 project using the Stevens et al. Level 1 protocol.

Fig 12.1 Intermittent Spring: The reported spring location in a dry drainage. Photo match 2011, facing downstream.

Physical Description: Intermittent Spring is a rheocrene/hypocrene spring. The reported coordinates are mapped in a rocky, boulder-strewn, south-facing channel near an unmarked road. As the name implies, it was dry in October 2020 when an SSI/FNW crew attempted to locate it. They found evidence of groundwater flow - magnesium precipitate - in the channel 30 meters upstream of the mapped location.

Access Directions: From Hwy 160 about 5 miles southeast of the town of Pahrump, turn north onto Trout Canyon Road. Drive for 7 miles to an unmarked dirt road on the left (northwest). Turn onto this road and drive or walk about 2.7 miles to the site. The road passes through a wash and is not passable by any vehicle other than an ATV or 4WD jeep.

Survey Notes: The site was dry where it was mapped and for 200 or more meters in the channel upstream and downstream and in the nearby channels. Surveyors found evidence of past seepage 30 meters upstream of the mapped point in the form of magnesium precipitate. Surveyors recommend returning during a wetter season.

Assessment: Assessment scores were compiled in 5 categories and 28 subcategories, with 14 null condition scores, and 11 null risk scores. Aquifer functionality and water quality are good with significant restoration potential (average condition score 4.8) and there is negligible risk (average risk score 1). Geomorphology condition is very good with excellent restoration potential (average condition score 5) and there is low risk (average risk score 2). Habitat condition is excellent with no need for restoration (average condition score 6.3) and there is negligible risk (average risk score 1). Biotic integrity is very good with excellent restoration potential (average condition score 5) and there is negligible risk (average risk score 1.6). Human influence of site is moderate with some restoration potential (average condition score 3.6) and there is moderate risk (average risk score 3.3). Overall, the site condition is good with significant restoration potential and there is low risk.

Table 12.1 Intermittent Spring Assessment Scores. Condition scores range from 0 (extremely poor condition) to 6 (pristine condition) and risk scores range from 0 (no risk to the site) to 6 (extreme risk to the site).

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.8	1
Geomorphology	5	2
Habitat	6.3	1
Biota	5	1.6
Human Influence	3.6	3.3
Overall Ecological Score	4.6	1.9

Management Recommendations: This naturally ephemeral spring does not warrant management attention, except determining the periodicity and range of discharge.

Fig 12.2 Intermittent Spring: The reported spring location in a dry drainage. Photo match 2011, facing upstream.

Fig 12.3 Intermittent Spring: The dry channel 30 m upstream of the reported spring location, where there is a small amount of chemical precipitate (not readily visible) indicating past spring flow.

13. Kiup Spring, 10/06/20
Survey Summary Report, Site ID 19689
Submitted 2/11/22 by Springs Stewardship Institute

Location: The Kiup Spring ecosystem is located in Clark County in the Ivanpah-Pahrump Valleys 16060015 HUC, managed by the US Bureau of Land Management. The spring is located in the Bureau of Land Management NV, in the Griffith Peak USGS Quad, at 36.16358, -115.72523 measured using a GPS (WGS84, estimated position error 3 meters). The elevation is approximately 1536 meters. Larry Stevens, Jeri Ledbetter, Talia Bar Yaacov, and Tara Blake surveyed the site on 10/06/20 for 03:45 hours, beginning at 11:15, and collected data in 10 of 10 categories. This survey was conducted under the Clark County SSI 2020 project using the Stevens et al. Level 2 protocol.

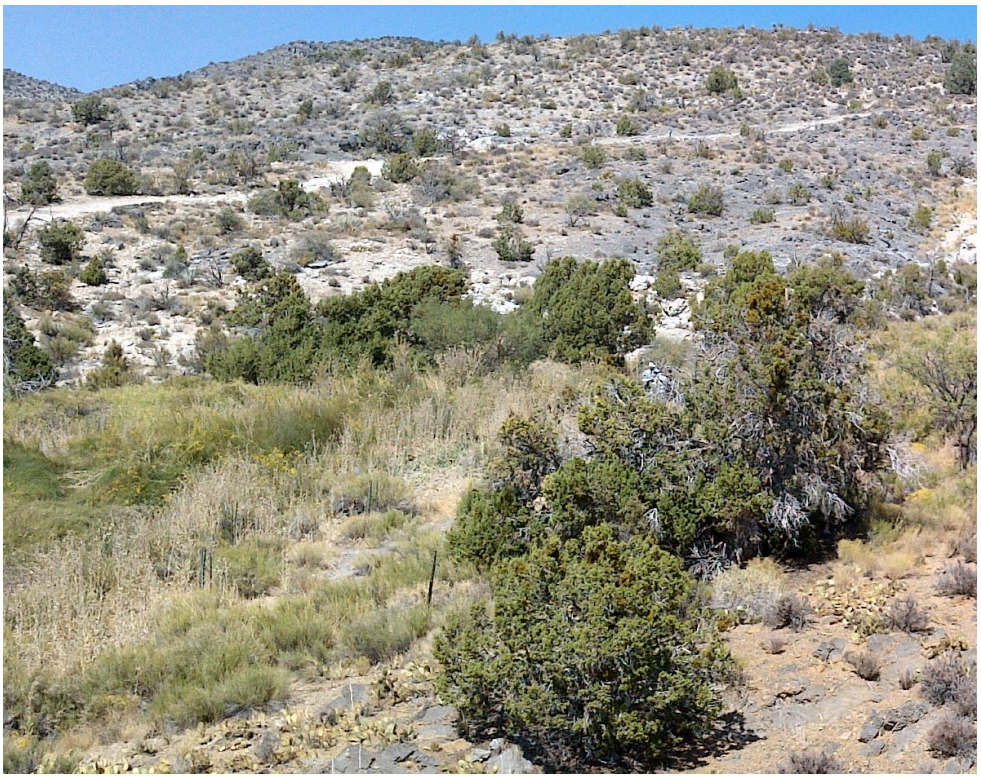

Fig 13.1 Kiup Spring: The springs ecosystem, on a travertine mound in the southern Spring Mountains. The field crew is clustered around the source (right of center). The white dirt road in the background leads north to Upper Kiup Spring.

Physical Description: Kiup Spring is a helocrene spring. Seepage emerges from the south-facing slope of a travertine mound in the southern Spring Mountains. There is a vertical section of culvert pipe installed at the spring source, which serves as an open springbox. The narrow springbrook is armored by naturally deposited travertine, but flanked with patches of low gradient cienega. The site has been heavily manipulated, used for livestock, and burned sometime between 2010 and 2020. It is a restoration site; as of 2020, there are Goodings willow and coyote willow planted and protected by

wire cages. Sada and Nachlinger in 1996 noted that the springs ecosystem was in good condition (probably near reference condition) and had naturalized from the disturbance associated with installing the culvert springbox. They did not believe that its naturalized condition had negatively affected springsnail abundance. There is a solar powered structure, possibly a groundwater monitoring well, 20 meters east of the source. Some data for this spring were imported in February 2016 from a compilation of Don Sada's research, and the Land Manager ID number is from this dataset. The microhabitats associated with the spring cover 1210.6 sqm. The site has 3 microhabitats, including A -- a 7 sqm channel, B -- a 572 sqm low gradient cienega, C -- a 632 sqm terrace. The geomorphic diversity is 0.31, based on the Shannon-Weiner diversity index.

Geomorphology: Kiup Spring emerges as a seepage or filtration spring from a sedimentary, unconsolidated rock layer. The emergence environment is subaerial, with a gravity flow force mechanism. The site receives approximately 98% of available solar radiation, with 6670 Mj annually.

Access Directions: From Hwy 160 about 5 miles east of the town of Pahrump, turn north onto Trout Canyon Road and drive for about 7.5 miles. Turn left (northwest) onto FR 550A. Drive for 1 mile. The spring is adjacent to the road, on the right (east) side. A UTV is the best vehicle for this road.

Survey Notes: Water depth in the vertical culvert springbox was 26 cm. The site is recovering from a burn that occurred within the last decade. There is evidence of target shooting nearby, with many shell casings. There is significant elk trampling, scat, and beds. There are trails on both sides and throughout the site and surrounding area. Surveyors took a 45 minute lunch break and continued to observe wildlife during that time. There are old and newly developed pedestals. The springsnail population is only about 500 individuals at this time, due in part to elk trampling and the absence of firm substrate.

Flow: Surveyors measured a flow of 0.14 liters/second, using a timed flow volume capture method. The surveyors measured flow 65 m downstream from the culvert springbox, at 36.16300, -115.72539. This spring is perennial.

Water Quality: The surveyor measured water quality in the vertical culvert springbox at the source, in barely flowing water, 26 cm deep. Location 1: at the spring source in flowing water at 12:12.

Table 13.1 Kiup Spring Water Quality Measurements.

Characteristic Measured	Value	Location Number	Device
Dissolved oxygen (field) (mg/L)	6	1	CHEMets DO kit
Dissolved Solids (field) (ppt)	0.395	1	Hanna Multi 98194
pH (field)	6.92	1	Hanna Multi 98194
Specific conductance (field) (µS/cm)	790	1	Hanna Multi 98194
Temperature, air C	33.5	1	Handheld therm
Temperature, water C	18.86	1	Hanna Multi 98194

Flora: Larry Stevens was the botanist. Surveyors identified 25 plant species at the site, with 0.0207 species/sqm. These included 20 native and 5 nonnative species.

Table 13.2 Kiup Spring Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	15	10
Shrub	10	4
Mid-canopy	1	0
Tall canopy	0	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 13.3 Kiup Spring Vegetation % Cover in Microhabitats.

Plant Species	Cover Code	Native Status	Wetland Status	Comments	A	B	C
Atriplex canescens	SC	N	F		0	0	1
Baccharis sergiloides	SC	N	F		10	8	8
Brassicaceae	GC	NI			0	0	1
Bromus rubens	GC	I	U		0	0	2
Centaurea	GC	I			0	0.1	5
Cirsium mohavense	GC	N	F		0	15	5
Eleocharis	GC	N	W		40	25	0
Fraxinus velutina	SC	N	R	planted and caged	0	1	0
Juncus articulatus	GC	N	W		1	0	0
Juncus balticus	SC	N	W		40	25	5
Juncus saximontanus	GC	N	W		0.01	0.3	0
Juniperus monosperma	MC	N	U		1	0.5	1
Juniperus monosperma	SC	N	U		5	2	1
Lythrum californicum	GC	N	W		0	2	0
Melilotus alba	GC	I	F		0	0.1	0.1
Muhlenbergia asperifolia	GC	N	WR		12	15	10
Phoradendron californicum	SC	N	F		0	0	0.01
Polypogon monspeliensis	GC	I	WR		0	0.1	0
Prosopis glandulosa	SC	N	F		0	1	5
Rhus trilobata	SC	N	F		0	3	0
Salix exigua	SC	N	WR	planted and caged	0	3	0
Salix gooddingii	SC	N	R	planted and caged	0	2	0
Schoenoplectus americanus	GC	N	W		0	0.2	0
Sisyrinchium	GC	N	WR	purple	0	0.2	0
Solidago canadensis	GC	N	WR		5	75	1
Trifolium repens	GC	I	WR		0	0.01	0

Fauna: Larry Stevens was the wildlife biologist at this site. Surveyors collected or observed 6 aquatic and 9 terrestrial invertebrate taxa and 9 vertebrate taxa.

Table 13.4 Kiup Spring Invertebrates.

Species	Lifestage	Habitat	Method	Rep#	Count	Species Detail
Amphipoda	Ad	A	Collected spot		10	
Amphipoda Hyalellidae Hyalella azteca	M	A	Spot		1	
Diptera Asilidae	Ad	T	Collected spot		1	Female
Hirudinida	Ad	A	Spot		1	leech
Hymenoptera Apidae Apis mellifera	Ad	T	Spot		1	many
Hymenoptera Apidae Xylocopa californica	Ad	T	Spot		6	
Hymenoptera Apoidea	Ad	T	Collected spot		1	
Isopoda	Ad	T	Collected spot		1	
Isopoda	M	T	Spot		1	
Lepidoptera Lycaenidae	Ad	T	Spot		1	
Neotaenioglossa Hydrobiidae Pyrgulopsis deaconi	M	A	Spot		1	
Odonata	L	A	Spot		1	
Odonata Coenagrionidae Argia vivida	Ad	T	Spot		1	many
Odonata Libellulidae Sympetrum	Ad	T	Spot		1	
Turbellaria	Ad	A	Collected spot		3	

Table 13.5 Kiup Spring Vertebrates.

Vertebrate Species Common Name	Count	Detection	Comments
Elk		sign	tracks, browsing damage, scat
Lesser Goldfinch	12		
House Finch	4		
Pocket Gopher		sign	burrows
Deer		sign	tracks
Gray Fox		sign	scat
Pinyon Jay	10	obs	
Western Scrub-jay	1	obs	
Kinglet	1	obs	ruby-crowned?

Assessment: Assessment scores were compiled in 5 categories and 33 subcategories, with 9 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are good with significant restoration potential (average condition score 4.2) and there is low risk (average risk score 2). Geomorphology condition is moderate with some restoration potential (average condition score 3.8) and there is low risk (average risk score 2.8). Habitat condition is good with significant restoration potential (average condition score 4) and there is low risk (average risk score 2.6). Biotic integrity is very good with excellent restoration potential (average condition score 5) and there is negligible risk (average risk score 1.8). Human influence of site is good with significant restoration potential (average condition score 4.3) and there is low risk (average risk score 1.9). Overall, the site condition is good with significant restoration potential and there is low risk.

Table 13.6 Kiup Spring Assessment Scores. Condition scores range from 0 (extremely poor condition) to 6 (pristine condition) and risk scores range from 0 (no risk to the site) to 6 (extreme risk to the site).

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.2	2
Geomorphology	3.8	2.8
Habitat	4	2.6
Biota	5	1.8
Human Influence	4.3	1.9
Overall Ecological Score	4.3	2.1

Management Recommendations: Get rid of the mesquite and remove the old iron fencing and barbed wire. Monitor the springsnail population size. Add more substrate to the springbrook to serve as springsnail habitat. Fence the source and meadow to reduce elk impacts, leaving water available at the downstream end.

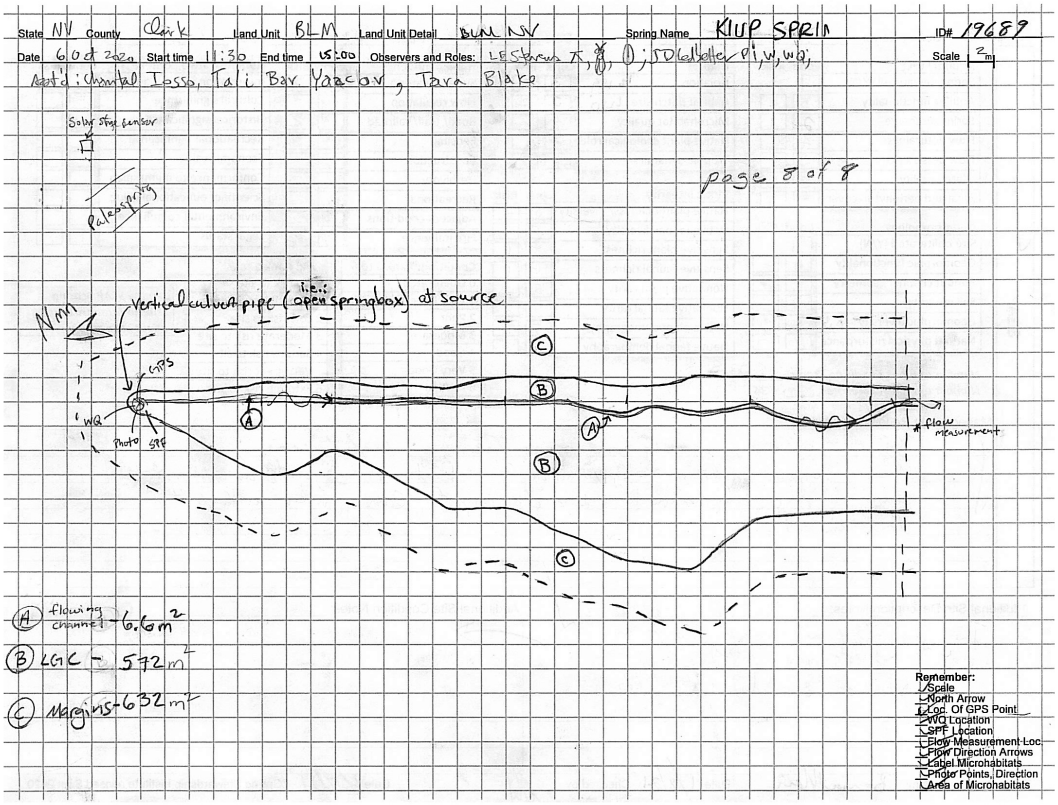

Fig 13.2 Kiup Spring Sketchmap.

Fig 13.3 Kiup Spring: The vertical section of culvert pipe serving as an open springbox at the source.

Fig 13.4 Kiup Spring: Crew wildlife biologist Larry Stevens prepares to catch a butterfly in the low gradient cienega. The spring source is behind the photographer, out of view.

14. Kiup Spring Upper, 10/06/20
Survey Summary Report, Site ID 249389
Submitted 2/11/22 by Springs Stewardship Institute

Location: The Kiup Spring Upper ecosystem is located in Clark County in the Ivanpah-Pahrump Valleys 16060015 HUC, managed by the US Bureau of Land Management. The spring is located in the Bureau of Land Management NV, in the Griffith Peak USGS Quad, at 36.16536, -115.72527 measured using a GPS (WGS84, estimated position error 3 meters). The elevation is approximately 1627 meters. Larry Stevens, Jeri Ledbetter, Talia Bar Yaacov, Chantal Iosso, and Tara Blake surveyed the site on 10/06/20 for 01:55 hours, beginning at 14:50, and collected data in 8 of 10 categories. This survey was conducted under the Clark County SSI 2020 project using the Stevens et al. Level 2 protocol.

Fig 14.1 Kiup Spring Upper: The field crew gathers around a muddy pozo, or hole dug by an animal to reach water. The pozo, although it lacks exposed water, is the wettest spot in this dry springs ecosystem.

Physical Description: Kiup Spring Upper is a helocrene/hypocrene spring. This springs ecosystem is low gradient cienega with a channel that passes through the center of the cienega. The spring is on a southeast-facing slope vegetated with pinyons and junipers and adjacent to a dirt road. There is no evidence of major human manipulation other than the road that crosses the outflow channel 20 meters downslope of the source. There are also remains of a very old rock dam at the downstream end of the site near the road. The microhabitats associated with the spring cover 115 sqm. The site has 2 microhabitats, including A -- a 9 sqm channel, B -- a 106 sqm low gradient cienega. The geomorphic diversity is 0.12, based on the Shannon-Weiner diversity index.

Geomorphology: Kiup Spring Upper emerges as a seepage or filtration spring from a sedimentary, unconsolidated rock layer. The emergence environment is subaerial, with a gravity flow force mechanism. The site receives approximately 97% of available solar radiation, with 6564 Mj annually.

Access Directions: From Hwy 160 about 5 miles east of the town of Pahrump, turn north onto Trout Canyon Road and drive for about 7.5 miles. Turn left (northwest) onto FR 550A. Drive for 1.2 miles. The spring is adjacent to the road, on the left (northwest) side. A UTV is the best vehicle for this road.

Survey Notes: This spring is not flowing and has no surface water, but in the channel there is a small (10 centimeter diameter) pozo with damp soil in the bottom. There are abundant pedestals from trampling by elk and livestock in the past.

Flow: There is a small muddy pozo, 10 cm in diameter, but no exposed water. This spring is ephemeral. Surveyors were unable to measure flow because the spring was dry at the time of the survey.

Flora: Larry Stevens was the botanist. Surveyors identified 8 plant species at the site, with 0.0696 species/sqm. These included 8 native and 0 nonnative species.

Table 14.1 Kiup Spring Upper Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	6	5
Shrub	2	0
Mid-canopy	0	0
Tall canopy	0	0
Basal	0	0
Aquatic	0	0
Non-vascular	0	0

Table 14.2 Kiup Spring Upper Vegetation % Cover in Microhabitats.

Plant Species	Cover Code	Native Status	Wetland Status	Comments	A	B
Baccharis sergiloides	GC	N	F	seedlings	3	3
Baccharis sergiloides	SC	N	F		5	15
Eleocharis	GC	N	W		12	2
Juncus balticus	GC	N	W		2	10
Juncus saximontanus	GC	N	W		0.1	0
Juniperus osteosperma	SC	N	U		0	2
Muhlenbergia asperifolia	GC	N	WR		25	20
Sisyrinchium	GC	N	WR		0	0.01

Fauna: Larry Stevens was the wildlife biologist at this site. Surveyors collected or observed 1 terrestrial invertebrate taxon and 4 vertebrate taxa.

Table 14.3 Kiup Spring Upper Invertebrates.

Species	Lifestage	Habitat	Method	Rep#	Count	Species Detail
Lepidoptera Nymphalidae Vanessa cardui	Ad	T	Spot		1	

Table 14.4 Kiup Spring Upper Vertebrates.

Vertebrate Species Common Name	Count	Detection	Comments
Deer		sign	scat
Cottontail Rabbit		sign	scat
Domestic Cow		sign	very old scat
Gray Fox		sign	scat nearby

Assessment: Assessment scores were compiled in 5 categories and 32 subcategories, with 10 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are very good with excellent restoration potential (average condition score 5) and there is moderate risk (average risk score 3.8). Geomorphology condition is moderate with some restoration potential (average condition score 3.6) and there is low risk (average risk score 2.2). Habitat condition is good with significant restoration potential (average condition score 4.2) and there is negligible risk (average risk score 1.8). Biotic integrity is very good with excellent restoration potential (average condition score 4.9) and there is low risk (average risk score 2). Human influence of site is very good with excellent restoration potential (average condition score 5.4) and there is low risk (average risk score 2.8). Overall, the site condition is good with significant restoration potential and there is low risk.

Table 14.5 Kiup Spring Upper Assessment Scores. Condition scores range from 0 (extremely poor condition) to 6 (pristine condition) and risk scores range from 0 (no risk to the site) to 6 (extreme risk to the site).

Category	Condition	Risk
Aquifer Functionality & Water Quality	5	3.8
Geomorphology	3.6	2.2
Habitat	4.2	1.8
Biota	4.9	2
Human Influence	5.4	2.8
Overall Ecological Score	4.8	2.5

Management Recommendations: Monitor this site to determine the flow timing and extent.

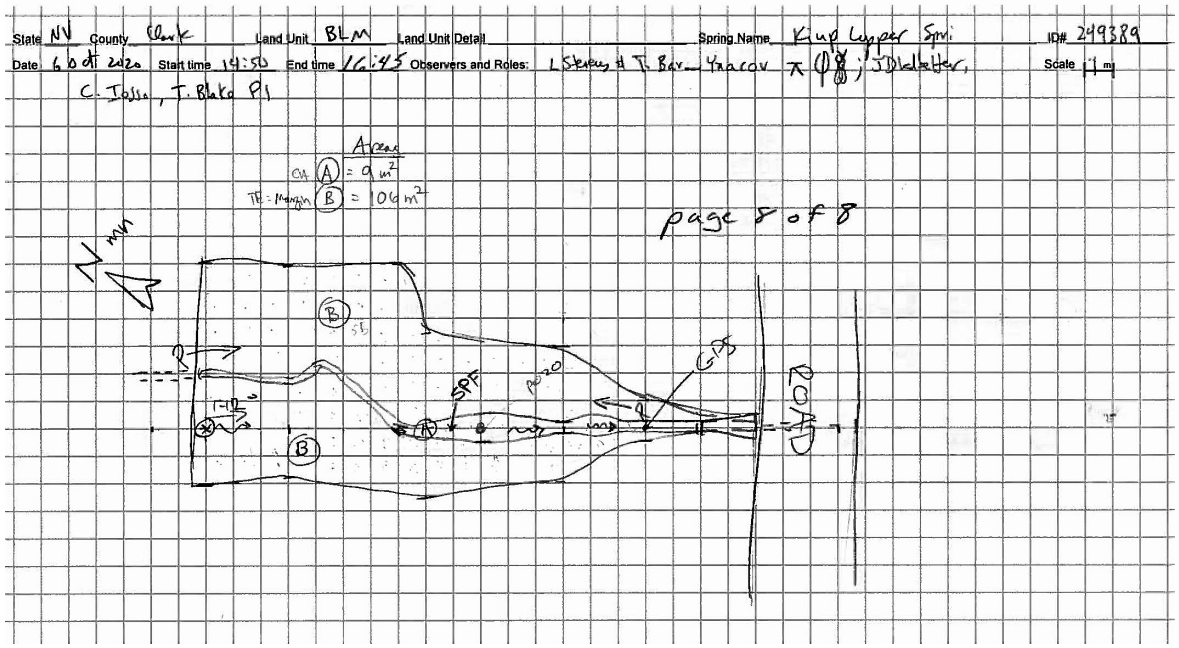

Fig 14.2 Kiup Spring Upper Sketchmap.

Fig 14.3 Kiup Spring Upper: The dry cienega. The photographer is at the upstream end of the springs ecosystem, facing downslope.

15. Little Finland Seep, 12/04/20
Survey Summary Report, Site ID 251544
Submitted 2/11/22 by Springs Stewardship Institute

Location: The Little Finland Seep ecosystem is located in Clark County in the Lake Mead Arizona, Nevada 15010005 HUC, managed by the US Bureau of Land Management. The spring is located in the Gold Butte National Monument, in the Devils Throat USGS Quad, at 36.44838, -114.21423 measured using a GPS (WGS84, estimated position error 8 meters). The elevation is approximately 556 meters. Andrea Hazelton and Brianna Mann surveyed the site on 12/04/20 for 01:00 hours, beginning at 15:00, and collected data in 9 of 10 categories. This survey was conducted under the Clark County SSI 2020 project using the Stevens et al. Level 2 protocol.

Fig 15.1 Little Finland Seep: The seepline, running along the base of this sandstone cliff. Note the abundant chemical precipitates deposited along the seepline; the water quality results show discharge from this spring to be exceptionally salty. The sandstone fins at the top of the cliff form part of the Little Finland hiking area.

Physical Description: Little Finland Seep is a hanging garden spring. Seepage emerges from a horizontal seep line on a red sandstone wall and runs for 900 meters. There is a dirt parking area near the north end. This parking area gives access to a section of the seep that is protected by a modern barbed wire fence. Within this fence, there are remnants of an old corral made of native rocks. A hiking trail leads from this corral toward the south along the seepline in a drainage. At the south end of the seepline, the

trail climbs up the sandstone wall for access to the Little Finland slickrock above. There are small pools and a couple of trickling streams issuing from the seepline in several places along its 900 meter length. The microhabitats associated with the spring cover 250 sqm. The site has 2 microhabitats, including A -- a 100 sqm backwall, B -- a 150 sqm colluvial slope. The geomorphic diversity is 0.29, based on the Shannon-Weiner diversity index.

Geomorphology: Little Finland Seep emerges as a contact spring from a sedimentary, sandstone rock layer. The emergence environment is subaerial, with a gravity flow force mechanism. The site receives approximately 59% of available solar radiation, with 3984 Mj annually.

Access Directions: This spring is in Gold Butte National Monument, where, as of 2020, most roads lack names or numbers. Surveyors should bring a topo map and GPS to navigate to this spring. From I-15, at Riverside, NV, drive south on Gold Butte Road for about 30 miles. Near Devil's Throat, turn west and follow signs toward Little Finland. This route will take you down a wash for about 5 miles, where there is another sign to turn north out of the wash to reach Little Finland. The Little Finland parking area is immediately south of the seep.

Survey Notes: This Level 2 survey describes the northernmost 50 meters of this 900 meter long seep. It is more or less representative of the conditions throughout this entire seep. See the 12/5/2020 survey sketchmap to place this survey area in the context of the entire site. Within this segment of Little Finland Seep, the seepline is seeping enough that the sandstone wall is visibly wet, but the seepage is patchy. There are 3 small puddles of water at the base of the sandy slope under the seep line. There is abundant precipitate on the sandstone wall and the slope beneath it. This seep supports very little wetland vegetation. There are 3 palm trees about 6-8 meters tall growing out of the moist, sandy slope below the seepline.

Flow: The flow rate was visually estimated at less than 0.1 L/sec. Water is seeping out of the rock face at a rate that is not perceptible. This spring is perennial. Surveyors were unable to measure flow because there was too little outflow to measure.

Water Quality: The surveyor measured water quality in a puddle just below the seeping wall, beneath a palm tree. Location 1: down-gradient from the spring source in standing water at 15:15.

Table 15.1 Little Finland Seep Water Quality Measurements.

Characteristic Measured	Value	Location Number	Device
Alkalinity, Total (mg/L)	240	1	LaMotte
Dissolved Solids (field) (ppt)	1.918	1	Hanna Multi 98194
pH (field)	8.34	1	Hanna Multi 98194
Specific conductance (field) (µS/cm)	2874	1	Hanna Multi 98194
Temperature, air C	22	1	Handheld therm
Temperature, water C	11.93	1	Hanna Multi 98194

Flora: Andrea Hazelton was the botanist. Surveyors identified 8 plant species at the site, with 0.032 species/sqm. These included 8 native and 0 nonnative species.

Table 15.2 Little Finland Seep Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	5	3
Shrub	2	0
Mid-canopy	1	0
Tall canopy	0	0
Basal	0	0
Aquatic	0	0
Non-vascular	1	0

Table 15.3 Little Finland Seep Vegetation % Cover in Microhabitats.

Plant Species	Cover Code	Native Status	Wetland Status	Comments	A	B
Anemopsis californica	GC	N	W		1	2
Cirsium virginense	GC	N	F	sending to expert for ID	0.5	3
Isocoma acradenia	SC	N	R		0	5
Juncus macrophyllus	GC	N	WR		0.5	2
Muhlenbergia	GC	N	U	tufted perennial	0	10
Muhlenbergia asperifolia	GC	N	WR		3	5
unknown Bryophyte (moss, liverwort, hornwort)	NV	N?			25	0
Washingtonia filifera	MC	N	F		0	4
Washingtonia filifera	SC	N	F		0	4

Fauna: The surface water in the largest, northernmost pool has a large pile of scat and moth wings, likely from bats. No aquatic invertebrates were observed. Brianna Mann was the wildlife biologist at this site. Surveyors collected or observed 3 vertebrate taxa.

Table 15.4 Little Finland Seep Vertebrates.

Vertebrate Species Common Name	Count	Detection	Comments
Domestic Dog		sign	scat
Squirrel		sign	ground squirrel burrows, tracks, scat
Bat		sign	scat

Assessment: Assessment scores were compiled in 5 categories and 32 subcategories, with 10 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are good with significant restoration potential (average condition score 4.2) and there is low risk (average risk score 2). Geomorphology condition is very good with excellent restoration potential (average condition score 5) and there is negligible risk (average risk score 0.2). Habitat condition is moderate with some restoration potential (average condition score 3) and there is negligible risk (average risk score 1.6). Biotic integrity is good with significant restoration potential (average condition score 4) and there is negligible risk (average risk score 1.5). Human influence of site is very good with excellent restoration potential (average condition score 5.3) and there is negligible risk (average risk score 1.4). Overall, the site condition is good with significant restoration potential and there is negligible risk.

Table 15.5 Little Finland Seep Assessment Scores. Condition scores range from 0 (extremely poor condition) to 6 (pristine condition) and risk scores range from 0 (no risk to the site) to 6 (extreme risk to the site).

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.2	2
Geomorphology	5	0.2
Habitat	3	1.6
Biota	4	1.5
Human Influence	5.3	1.4
Overall Ecological Score	4.4	1.4

Management Recommendations: This spring is right next to and in view of popular OHV trails. While in excellent condition, its location makes it vulnerable to damage by human visitors as well as feral equines. The water is probably too salty for livestock and most wildlife, but some of the vegetation may be vulnerable to grazing. Surveyors recommend monitoring this spring to make sure it remains in good condition. Land managers may want to remove the three relatively young palm trees that, while picturesque, could eventually produce many seedlings and even be a seed source to nearby springs (transported by birds). This spring does not appear to support aquatic life, though managers may wish to monitor in wetter periods for seasonal aquatic invertebrates.

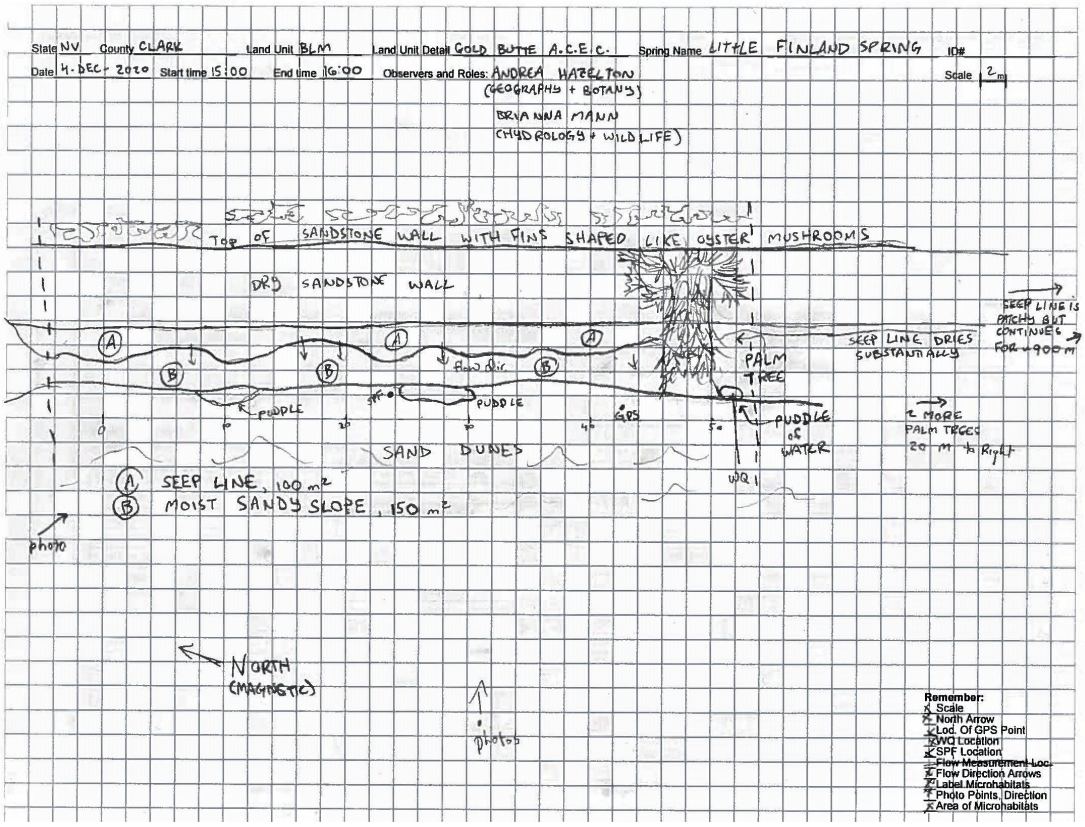

Fig 15.2 Little Finland Seep Sketchmap.

Fig 15.3 Little Finland Seep: This section of the seepline produces enough moisture to form a shallow pool in the sand at the base of the cliff (at bottom center of photo).

16. Little Finland Seep, 12/05/20
Survey Summary Report, Site ID 251544
Submitted 2/11/22 by Springs Stewardship Institute

Location: The Little Finland Seep ecosystem is located in Clark County in the Lake Mead Arizona, Nevada 15010005 HUC, managed by the US Bureau of Land Management. The spring is located in the Gold Butte National Monument, in the Devils Throat USGS Quad, at 36.44838, -114.21423 measured using a GPS (WGS84, estimated position error 8 meters). The elevation is approximately 556 meters. Andrea Hazelton and Brianna Mann verified the site on 12/05/20 at 15:00. This survey was conducted under the Clark County SSI 2020 project using the Stevens et al. Level 1 protocol.

Fig 16.1 Little Finland Seep: The south half of the seepline, emerging from the cliff on the left and running parallel with a dry wash. A hiking trail (not visible) leads up the wash for about 500 meters before climbing up the cliff wall to access the Little Finland slickrock (left half of photo).

Physical Description: Little Finland Seep is a hanging garden spring. Seepage emerges from a horizontal seep line on a red sandstone wall and runs for 900 meters. There is a dirt parking area near the north end. This parking area gives access to a section of the seep that is protected by a modern barbed wire fence. Within this fence, there are remnants of an old corral made of native rocks. A hiking trail leads from this corral toward the south along the seepline in a drainage. At the south end of the seepline, the trail climbs up the sandstone wall for access to the Little Finland slickrock above. There are small pools and a couple of trickling streams issuing from the seepline in several places along its 900 meter length.

Geomorphology: Little Finland Seep emerges as a contact spring from a sedimentary, sandstone rock layer. The emergence environment is subaerial, with a gravity flow force mechanism. The site receives approximately 59% of available solar radiation, with 3984 Mj annually.

Access Directions: This spring is in Gold Butte National Monument, where, as of 2020, most roads lack names or numbers. Surveyors should bring a topo map and GPS to navigate to this spring. From I-15, at Riverside, NV, drive south on Gold Butte Road for about 30 miles. Near Devil's Throat, turn west and follow signs toward Little Finland. This route will take you down a wash for about 5 miles, where there is another sign to turn north out of the wash to reach Little Finland. The Little Finland parking area is immediately south of the seep.

Survey Notes: The majority of the seepline is releasing only enough water to support patchy, facultative riparian vegetation and create moist but not wet patches of cliff wall and sand. In some places the seepline is entirely dry and in others enough moisture is released to form puddles at the base of the sandstone wall. There is substantial cover of precipitates on the wall and the sandy slope below. This survey was done on a Saturday in December and surveyors observed a few human visitors hiking, plus several more driving past on ATVs. There was no trash at the spring, but one visitor reported that a petroglyph near the rock corral had been defaced.

Fauna: Brianna Mann was the wildlife biologist at this site. Surveyors collected or observed 1 aquatic and 1 terrestrial invertebrate taxa and 3 vertebrate taxa.

Table 16.1 Little Finland Seep Invertebrates.

Species	Lifestage	Habitat	Method	Rep#	Count	Species Detail
Diptera Culicidae Culiseta	L	A	Spot		100	many
Odonata	Ad	T	Spot		2	blue

Table 16.2 Little Finland Seep Vertebrates.

Vertebrate Species Common Name	Count	Detection	Comments
Horse		sign	scat
Rodent		sign	scat
Domestic Dog	1	obs	companion to a hiker; scat also observed

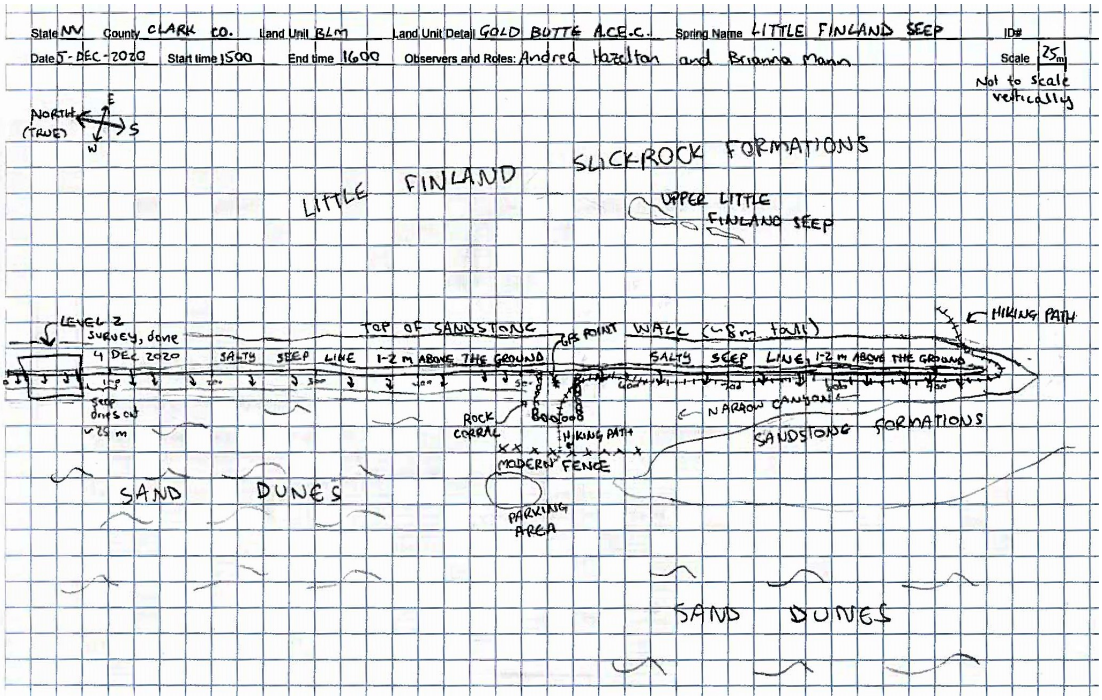

Fig 16.2 Little Finland Seep Sketchmap.

Fig 16.3 Little Finland Seep: The seepline runs along this sandstone cliff, near its base. Note the several palm trees, which are supported by this seep. Photo taken from a vantage north of the northernmost end of the seepline.

Fig 16.4 Little Finland Seep: A portion of the rock wall which forms a corral in front of the seep. Deposits of chemical precipitates associated with the seep are visible on the sandstone cliff. The Little Finand parking area is behind the photographer.

17. Lower Cougar Spring, 10/16/20
Survey Summary Report, Site ID 1193

Submitted 2/11/22 by Springs Stewardship Institute

Location: The Lower Cougar Spring ecosystem is located in Clark County in the Sand Spring-Tikaboo Valleys 16060014 HUC, managed by the US Forest Service. The spring is located in the Humboldt-Toiyabe NF, Spring Mountains NRA, in the Willow Peak USGS Quad, at 36.40807, -115.79649 measured using a GPS (WGS84, estimated position error 4 meters). The elevation is approximately 2206 meters. Andrea Hazelton and Brianna Mann verified the site on 10/16/20 at 16:30. This survey was conducted under the Clark County SSI 2020 project using the Stevens et al. Level 1 protocol.

Fig 17.1 Lower Cougar Spring: The reported spring location in the bed of a steep narrow drainage, viewed from 5 meters downslope. This soil is dry and there is no riparian vegetation.

Physical Description: Lower Cougar Spring is a hillslope/rheocrene spring. This reported spring location is mapped in the channel of a steep drainage on the north side of the spring mountains. When surveyors visited in October 2020, there was no evidence of a spring. Prior to this, light, ephemeral seepage was reported along the canyon walls.

Geomorphology: Lower Cougar Spring emerges as a bedding spring from a sedimentary, unconsolidated rock layer. The emergence environment is subaerial. The site receives approximately 50% of available solar radiation, with 5102 Mj annually.

Access Directions: From Las Vegas, drive north on Hwy 95 for about 30 miles and turn left (SW) on Cold Creek Road (SR 372). Follow this road for about 13 miles to the community of Cold Creek. Just before entering the community, turn right (west) onto Wheeler Pass Road, a major dirt road. Drive for about 6 miles on Wheeler Pass Road. Park at a campground pullout on the right side of the road, at 36.403966 N, 115.787710 W. Walk west up the drainage along an old jeep road for 900 meters. Drop over the saddle to the next canyon to the northwest. The site is in the bed of this canyon. The hike is best reached by following horse trails that cross the hillside and canyon.

Survey Notes: Surveyors searched the drainage for 80 meters upstream of the reported location and 100 meters downstream of the reported location and found no evidence of a spring. Soil was dry and there was no riparian vegetation or springs development infrastructure. There is abundant elk sign and some skunk scat in the area.

18. Macks Canyon Spring 1, 8/07/20
Survey Summary Report, Site ID 617
Submitted 2/11/22 by Springs Stewardship Institute

Location: The Macks Canyon Spring 1 ecosystem is located in Clark County in the Las Vegas Wash 15010015 HUC, managed by the US Forest Service. The spring is located in the Humboldt-Toiyabe NF, Spring Mountains NRA, in the Charleston Peak USGS Quad, at 36.34944, -115.67999 measured using a GPS (WGS84, estimated position error 5 meters). The elevation is approximately 2497 meters. Larry Stevens, Jeri Ledbetter, and Chantal Iosso surveyed the site on 8/07/20 for 05:00 hours, beginning at 10:00, and collected data in 10 of 10 categories. This survey was conducted under the Clark County SSI 2020 project using the Stevens/GDE hybrid protocol.

Fig 18.1 Macks Canyon Spring 1: The low gradient cienega and channel, as viewed from the excavated source.

Physical Description: Macks Canyon Spring 1 is a helocrene/hillslope spring. For the region, this is a large springs complex, with at least three sources. Flow seeps diffusely from a north-sloping hillside in Mack's Canyon and quickly focuses into channels that merge to create a runout stream that flows for approximately 50 meters east. The substrate is organic matter and the site is open but surrounded by a mature pine-fir forest. The spring is adjacent to a parking area that is regularly visited and used for camping. The uppermost source has been excavated with a steel tank and piping is installed. This infrastructure has long been nonfunctional and is filled completely with

sediment. According to a land manager in 2010, fencing was installed to keep cows away from the site while allowing deer to access the water. There is black, non-functional 1-inch tubing strewn throughout the site and within in the outflow channel. The microhabitats associated with the spring cover 707 sqm. The site has 5 microhabitats, including A -- a 326 sqm high gradient cienega, B -- a 123 sqm low gradient cienega, C -- a 154 sqm low gradient cienega, D -- a 94 sqm terrace, E -- a 10 sqm channel. The geomorphic diversity is 0.57, based on the Shannon-Weiner diversity index.

Geomorphology: Macks Canyon Spring 1 emerges as a seepage or filtration spring from a sedimentary, unconsolidated rock layer. The emergence environment is subaerial, with a gravity flow force mechanism. The site receives approximately 87% of available solar radiation, with 6397 Mj annually.

Access Directions: From Las Vegas, north on Highway 95 to State Road 156, Lee Canyon Road. Turn left, drive about 13 miles, and turn right on Mack's Canyon Road. Follow this dirt road that becomes increasingly bumpy and narrow, about 4 miles. The spring is just left of the road, adjacent to the parking area.

Survey Notes: Trails pass around and through the site. There is a lot of trash throughout the spring microhabitats and surrounding area. With no toilet facilities at a regularly used camping area, the surrounding areas - including the springs ecosystems - are often used. The spring and surrounding area are heavily trampled, grazed, and browsed, with formation of pedestals. The fence is down on the upper end near the source. The piping and development is rusty and ineffective. The upper high gradient cienega has slumped into the lower microhabitat, leaving coarser grained material above. This is possibly due to legacy grazing effects or hydrologic manipulation of the site.

Flow: Surveyors measured a flow of 0.064 liters/second, using a flume. Flow was adjusted for an estimate of 98% of site flow capture. Surveyors measured flow 34 m downhill from the upstream end of the site, 6 m downstream of where all flow coalesces into a single channel. The stage was 0.1 inches on a 1 inch flume, or 2.25 gpm. This spring is perennial.

Water Quality: Surveyors measured water chemistry at the excavated source. Location 1: at the spring source in standing water at 12:12.

Table 18.1 Macks Canyon Spring 1 Water Quality Measurements.

Characteristic Measured	Value	Location Number	Device
Temperature, air C	21		Handheld therm
Dissolved Solids (field) (ppt)	0.239	1	Hanna Multi 98194
pH (field)	7.1	1	Hanna Multi 98194
Specific conductance (field) (µS/cm)	479	1	Hanna Multi 98194
Temperature, water C	7.55	1	Hanna Multi 98194

Flora: Larry Stevens was the botanist. Surveyors identified 22 plant species at the site, with 0.0311 species/sqm. These included 21 native and 0 nonnative species; the native status of 1 species remains unknown.

Table 18.2 Macks Canyon Spring 1 Cover Type.

Cover Type	Species Count	Wetland Species Count
Ground	13	11
Shrub	6	0
Mid-canopy	2	0
Tall canopy	3	0
Basal	0	0
Aquatic	0	0
Non-vascular	2	2

Table 18.3 Macks Canyon Spring 1 Vegetation % Cover in Microhabitats.

Plant Species	Cover Code	Native Status	Wetland Status	Comments	A	B	C	D	E
algae	NV	N?	A		0.1	3	3	2	2
Angelica kingii	GC	N	WR		1	1	1	5	5
Aquilegia formosa	GC	N	W		1	0.1	0.1	1	1
Carex aurea	GC	N	W		3	10	5	0	0
Carex interior	GC	N	W		5	20	20	18	18
Carex subfusca	GC	N	W		2	2	0	0	0
Cupressaceae	MC				2	0	0	0	0
Cupressaceae	SC				2	0	0	0	0
Cupressaceae	TC				2	0	0	0	0
Deschampsia caespitosa	GC	N	WR		3	10	10	15	15
Epilobium ciliatum	GC	N	W		1	0.1	0.1	0.1	0.1
Equisetum laevigatum	GC	N	WR		1	4	5	5	5
Maianthemum	GC	N	U		0.1	0	0	0	0
Parnassia parviflora	GC	N	W		1	3	3	1	1
Pinus ponderosa	TC	N	U		1	0	0	0	0
Platanthera sparsiflora	GC	N	WR		4	3	3	2	2
Primula	GC	N	W		75	20	20	25	25
Pseudotsuga menziesii	MC	N	U		5	0	0	1	1
Pseudotsuga menziesii	SC	N	U		0	0	0	2	2
Pseudotsuga menziesii	TC	N	U		2	0	0	0	0
Ribes cereum	SC	N	U		1	0	0	2	2
Rosa woodsii	SC	N	F		2	0	0	2	2
Sambucus	SC	N	F		0.1	0	0	0	0
Senecio spartioides	SC	N	U		0.01	0	0	0	0
Solidago	GC	N	F		0.01	0	0	0	0
unknown moss	NV	N?	WR		35	10	10	15	15

Fauna: All the reported birds were watering and bathing at the site or outflow during the survey. The Coopers Hawks were bathing, drinking, and hunting song birds. Larry Stevens was the wildlife biologist at this site. Surveyors collected or observed 5 aquatic and 8 terrestrial invertebrate taxa and 12 vertebrate taxa.

Table 18.4 Macks Canyon Spring 1 Invertebrates.

Species	Lifestage	Habitat	Method	Rep#	Count	Species Detail
Annelida	Ad		Collected spot		1	
Coleoptera	L		Collected spot		7	
Coleoptera	Ad		Collected spot		1	
Diptera	Ad	T	Collected spot		19	
Hemiptera	I	T	Collected spot		1	
Hymenoptera Sphecidae Chlorion	Ad	T	Collected spot		1	
Mollusca	Ad		Collected spot		1	
Mollusca Gastropoda	Ad	T	Collected spot		1	landsnail
Neoophora Planariidae Dugesia	M	A	Collected spot		1	
Neuroptera	Ad	T	Collected spot		1	
Odonata Aeshnidae Aeshna	Ad	T	Spot		1	
Odonata Libellulidae Pantala flavescens	Ad	T	Spot		2	
Plecoptera	Ad	T	Collected spot		2	
Plecoptera	L	A	Collected spot		6	Peltoperlidae?
Trichoptera	L	A	Collected spot		8	
Turbellaria	Ad	A	Collected spot		2	

Table 18.5 Macks Canyon Spring 1 Vertebrates.

Vertebrate Species Common Name	Count	Detection	Comments
Mountain Chickadee	5	obs	
Dark-eyed Junco	8	obs	
Flycatcher	3	obs	relatively large - western?
Plumbeous Vireo	1	call	
Golden-mantled Ground Squirrel	1	obs	
Black-headed Grosbeak	1	obs	
Elk		sign	tracks and scat
Cooper's Hawk	3	obs	bathing, drinking, and hunting
Lazuli Bunting	1	obs	female
Common Raven	2	call	
Warbler	1	obs	black-faced, striped
Horse		sign	tracks and scat, seen nearby after survey

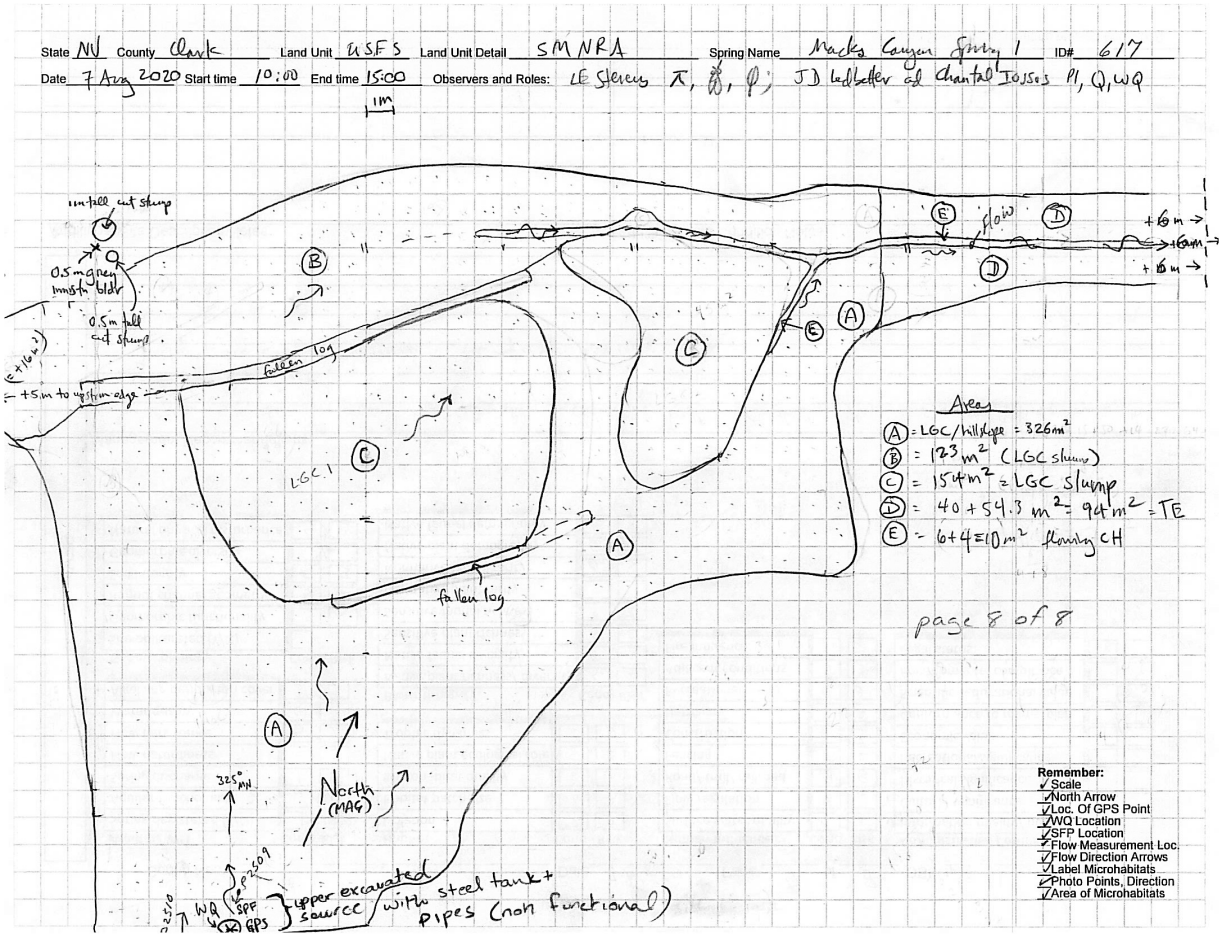

Fig 18.2 Macks Canyon Spring 1 Sketchmap.

Fig 18.3 Macks Canyon Spring 1: The excavated source with silted-in metal tank and pipes, as viewed from 3 meters downslope. The wood structure at the top of the photo is a fencepost.

Fig 18.4 Macks Canyon Spring 1: Flow measurement location, in the channel 34 meters down from the uphill end of the low gradient cienega.

Fig 18.5 Macks Canyon Spring 1: *Accipiter cooperii* (Cooper's Hawk)

19. Macks Canyon Spring 2, 8/08/20
Survey Summary Report, Site ID 18003

Submitted 2/11/22 by Springs Stewardship Institute

Location: The Macks Canyon Spring 2 ecosystem is located in Clark County in the Las Vegas Wash 15010015 HUC, managed by the US Forest Service. The spring is located in the Humboldt-Toiyabe NF, Spring Mountains NRA, in the Charleston Peak USGS Quad, at 36.34930, -115.68082 measured using a GPS (WGS84, estimated position error 4 meters). The elevation is approximately 2452 meters. Jeri Ledbetter, Larry Stevens, and Chantal Iosso verified the site on 8/08/20 at 15:30. This survey was conducted under the Clark County SSI 2020 project using the Stevens et al. Level 1 protocol.

Fig 19.1 Macks Canyon Spring 2: Overview of the spring. The photographer is facing upslope.

Physical Description: Macks Canyon Spring 2 is a hillslope/anthropogenic spring. This spring emerges on a hill above a parking lot and camp area that is frequently visited. The surrounding area is heavily forested. The site has been excavated and piped. The flow emerges from a pipe embedded in a vegetated hillslope. The pipe flows into a small pool which has been dug out and retained with rocks. The hillslope is the broad mouth of a drainage upslope. The substrate is soil and small limestone colluvial gravels. The spring is 20 meters from a popular dirt road and campground, and a foot path runs through the spring.

Geomorphology: Macks Canyon Spring 2 emerges as a fault spring from a sedimentary, limestone rock layer. The emergence environment is subaerial, with a gravity flow force mechanism. The site receives approximately 99% of available solar radiation, with 10176 Mj annually.

Access Directions: From Lee Canyon Road, turn right onto Macks Canyon Road and follow it four miles to the end, where the Wilderness Area begins. This is the last spring on the left.

Survey Notes: Horses and horse trampling are evident at the site, with some pedestal development. Trails go through and around the site. There is trash at the spring. A functional pipe collects flow from upslope and delivers water into a 40 centimeter excavated pool at the bottom of the site. Another excavated pool is dug out near the center of the site. Otherwise, seepage emerges diffusely and forms a small channel that flows for a few meters and then seeps back into the ground.

Flow: Surveyors measured a flow of 0.052 liters/second, using a timed flow volume capture method. Flow was adjusted for an estimate of 50% of site flow capture. The surveyor measured flow where it exits the pipe. This spring is perennial.

Water Quality: Surveyors measured water quality at an excavated pool in the emergence area. Water chemistry devices were calibrated about 5 hours prior. Location 1: at the spring source in standing water at 15:15.

Table 19.1 Macks Canyon Spring 2 Water Quality Measurements.

Characteristic Measured	Value	Location Number	Device
Dissolved Solids (field) (ppt)	0.27	1	Hanna Combo
pH (field)	7.99	1	Hanna Combo
Specific conductance (field) (µS/cm)	532	1	Hanna Combo
Temperature, air C	27	1	Handheld therm
Temperature, water C	15	1	Hanna Combo

Fauna: Fauna identified by Larry Stevens. Surveyors collected or observed 2 terrestrial invertebrate taxa and 4 vertebrate taxa.

Table 19.2 Macks Canyon Spring 2 Invertebrates.

Species	Lifestage	Habitat	Method	Rep#	Count	Species Detail
Coleoptera	Ad		Collected spot		4	
Diptera	Ad	T	Collected spot		25	
Diptera Culicomorpha	Ad	T	Spot		1	

Table 19.3 Macks Canyon Spring 2 Vertebrates.

Vertebrate Species Common Name	Count	Detection	Comments
Common Raven	2	call	
Dark-eyed Junco	3	obs	
Thrush	1	obs	
Horse	3	obs	

Assessment: Assessment scores were compiled in 5 categories and 29 subcategories, with 13 null condition scores, and 10 null risk scores. Aquifer functionality and water quality are good with significant restoration potential (average condition score 4) and there is low risk (average risk score 2.7). Geomorphology condition is good with significant restoration potential (average condition score 4) and there is moderate risk (average risk score 3). Habitat condition is good with significant restoration potential (average condition score 4.5) and there is low risk (average risk score 2). Biotic integrity is very good with excellent restoration potential (average condition score 4.9) and there is low risk (average risk score 2.4). Human influence of site is moderate with some restoration potential (average condition score 3.2) and there is moderate risk (average risk score 3.4). Overall, the site condition is good with significant restoration potential and there is low risk.

Table 19.4 Macks Canyon Spring 2 Assessment Scores. Condition scores range from 0 (extremely poor condition) to 6 (pristine condition) and risk scores range from 0 (no risk to the site) to 6 (extreme risk to the site).

Category	Condition	Risk
Aquifer Functionality & Water Quality	4	2.7
Geomorphology	4	3
Habitat	4.5	2
Biota	4.9	2.4
Human Influence	3.2	3.4
Overall Ecological Score	4	2.8

Management Recommendations: Fence the helocrene to exclude horses, leaving water available downslope. Monitor the spring occasionally. The horse trail entering the helocrene, from the top in particular, is shedding gravel and small boulders onto the helocrene surface, changing grain size.

Fig 19.2 Macks Canyon Spring 2: The pipe outflow into the excavated pool, where surveyors measured flow.

Fig 19.3 Macks Canyon Spring 2: The spring habitat and the adjacent parking and camping areas, viewed from above the source.